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JOURNAL OF THE

BOSTON SOCIETY OF CIVIL ENGINEERS

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Volume XXIII JULY, 1936 Number 3

THE BOSTON SOCIETY OF CIVIL ENGINEERS AND ITS FOUNDER MEMBERS

PRESIDENTIAL ADDRESS BY JOHN B. BABCOCK, 3D,* BOSTON SOCIETY OF CIVIL ENGINEERS
MARCH 18, 1936

> *April 26, 1848.* — An informal meeting of gentlemen engaged principally in Civil Engineering, having been called by private notification, was held at the United States Hotel in Boston, on Wednesday evening, April 26, 1848, to consider the expediency of taking measures to form a Society, for social intercourse and professional improvement, to be composed of civil engineers and of gentlemen engaged in pursuits kindred to civil engineering. Of about twelve persons invited, there were present only Messrs. J. H. Blake, G. M. Dexter, E. S. Chesbrough, H. S. McKean and W. S. Whitwell.
>
> The meeting was not formally organized. A general conversation took place on the subject of the proposed Society. A conviction that it was desirable to form one, and a willingness to co-operate for that object, was expressed by all present. The determination of the precise means to be used was deferred to a subsequent meeting which it was supposed would be more fully attended.
>
> After a light supper the meeting adjourned to meet at the same place on Monday evening, May 8th. H. S. M. [H. S. McKean.]

THIS informal gathering of five civil engineers of Boston at the United States Hotel, then one of the largest and most complete hostelries in the country, marked the first successful endeavor of civil engineers on this continent to unite for the advancement of the profession and for the improvement of its members. Their sincere conviction of the desirability of such an organization and their willingness to co-operate to attain that end are clearly expressed in the brief record above. At subsequent meetings, in which additional persons participated, the constitution and by-laws were adopted, and on July 3, 1848, the first regular meeting of the Boston Society of Civil Engineers was held. Today we are assembled at the eighty-eighth anniversary of the founding of that Society — *the oldest engineering society in the United States!*

---

* Professor of Railway Engineering, Massachusetts Institute of Technology, Cambridge, Mass.

Four years later the American Society of Civil Engineers and Architects was established in New York, and in 1869 the Civil Engineers Club of the Northwest (now the Western Society of Engineers) was founded in Chicago.

Several earlier efforts had been made to form an engineering society in this country. In 1836 a group of engineers connected with the Cincinnati & Charleston R.R. attempted to establish a National Society of Civil Engineers. At Baltimore in 1839 an American Society of Civil Engineers was proposed, but it never materialized. In 1841 the American Institute of Engineers was formed at Albany, N. Y., but it survived only a short time.*

The Baltimore convention (1839) resulted from a call from a "highly respectable meeting of the profession" held in Augusta, Ga. Unfortunately the record of this meeting in Augusta has not been found, but it seems likely that railroad engineers were the participants, as Augusta was the scene of much railroad construction at the time. The convention met on February 11, 1839, at Barnum's Hotel in Baltimore, and on the following day at the Maryland Academy of Science and Literature. Forty civil engineers from eleven different States attended. Benjamin H. Latrobe, an eminent railroad engineer, was elected president, and a committee of seventeen was appointed to draft a constitution, and a committee of five to prepare an address to the civil engineers of the country. The latter committee adopted an address on the subject which called attention to the "multitude of instructive examples" in America of engineering efforts to obtain "the greatest amount of useful effect at the smallest cost" and their usefulness to the profession if correct information in regard to them could be collected. At a meeting at the Franklin Institute in Philadelphia, which was rather poorly attended, the "committee of seventeen" drew up a constitution and submitted it to the other members of the committee. This constitution failed to receive the approval of the majority of the committee, and no further action seems to have been taken.†

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* *Transactions*, American Society of Civil Engineers, vol. XXIV.

† The account of the Baltimore Convention has been abstracted from the "Historical Sketch of the American Society of Civil Engineers, 1852–97."

ACTIVITIES OF THE BOSTON SOCIETY OF CIVIL ENGINEERS

Almost another decade was to pass before the successful formation of a society of civil engineers in this country — until July 3, 1848, when the Boston Society of Civil Engineers held its first regular meeting and elected the following officers: *James F. Baldwin*,* president; *George M. Dexter*, vice president; *John H. Blake*, secretary; *William P. Parrott*, treasurer; and *Joseph Bennett*, *Ellis S. Chesbrough*, *James Laurie*, *Samuel Nott* and *William S. Whitwell*, directors.

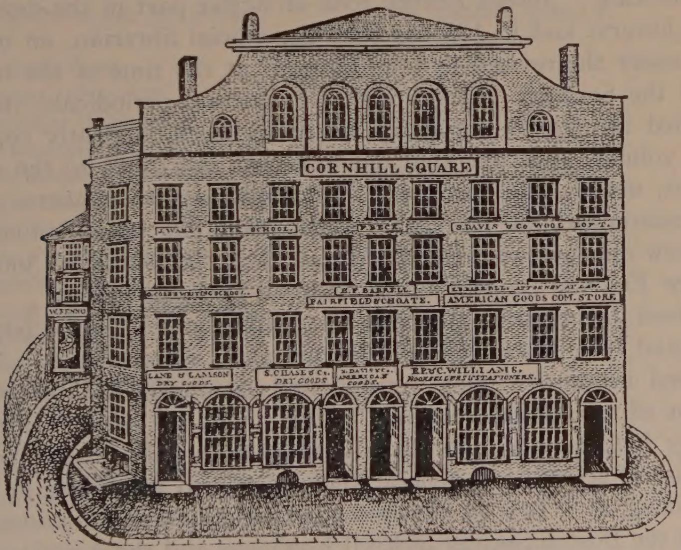
CORNHILL SQUARE
GREEK SCHOOL.
P. BECK
S. DAVIS & Co WOOL LOFT.
WRITING SCHOOL
H. F. BARRELL.
ATTORNEY AT LAW.
FAIRFIELD & CHOATE.
AMERICAN GOODS COM. STORE.
LANE & LAMSON DRY GOODS
S. CHASE & Co. DRY GOODS
AMERICAN GOODS
E.P. & C. WILLIAMS, BOOKSELLERS & STATIONERS.

FIG. 1. — JOY'S BUILDING

The Boston Society of Civil Engineers occupied room No. 14 from 1848 to 1853. Joy's Building was located on Washington Street nearly opposite the head of State Street. This engraving was made several years earlier, when this part of Washington Street was named Cornhill.

The desirability of securing quarters where meetings could be held and a library established was recognized at the outset, and arrangements were made to lease a room in Joy's Building on Washington Street at $100 per year. One of the tenants of this building was *Uriah A. Boyden*, a founder member of the Society, who maintained an office there for forty years. The following description of Joy's Building is quoted from a Boston directory published at that time:

---

* The names of all B. S. C. E. founder members are shown in *italics* throughout this paper.

> The edifice is admirably adapted to business purposes and for offices, being set in the center of the business section, nearly opposite the head of State Street. . . . It now resembles many European edifices in its interior arrangement, having a main entrance to the center, from which ascends a circular staircase to the top. Surrounding this, on each story, are located the offices — all large, airy and convenient.

A committee on library was appointed and appropriations made for the purchase of technical and scientific books and for subscriptions to periodicals.* *Joseph Bennett* took an active part in the development of the library, and in 1851 became the official librarian, an office provided under the revised by-laws adopted at the time of the incorporation of the Society. In addition to books and periodicals, the library contained the papers presented before the Society, neatly copied in a bound volume. Considerable attention was also given to the collection of plans, models and specimens of interest to the members. The Society maintained the room at 14 Joy's Building until January, 1853, when new quarters were established at 11½ Tremont Row, jointly with the New England Association of Railroad Superintendents.

James Laurie presented the first paper before the Society on the "Coal and Iron Trade of Great Britain and United States." This was published in the "Mining Journal and American Railroad Gazette" with the editorial comment that "judging from the paper of Mr. *Laurie*, we may look for valuable contributions from this Boston Society to the cause of science and general knowledge, and we rejoice in its existence among us." It is an interesting fact that *Laurie*, a founder member of both the Boston Society of Civil Engineers and the American Society of Civil Engineers, gave the first paper in each.

The papers presented were principally on railroads and hydraulics, the fields in which most of the members were then engaged. Locomotive boiler explosions were distressingly frequent in those days, and we find committee reports to the Society on explosions of the locomotives "Taghconic," "Piscataqua" and "Erie;" these reports were subsequently printed in full in Boston newspapers. Other railroad papers included "A Railroad to the Pacific," by Mr. P. P. F. Degrand, a Boston railroad broker; reports of railroad surveys with detailed estimates; and a noteworthy treatise on "Useful Formulæ Adapted to Locating

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* The fact that one third of the founder members of the Society became Proprietors of the Boston Athenæum indicates the interest that these early civil engineers took in educational matters and in the development of the profession.

FOUNDER MEMBERS OF THE BOSTON SOCIETY OF CIVIL ENGINEERS *

NAME AND YEAR OF BIRTH AND DEATH	Offices Held in the Society	Elected Honorary Member
Samuel Ashburner (1816–1891)	Director	–
James Fowle Baldwin (1782–1862)	President	–
Joseph Bennett (1814–1875)	Director, librarian	–
John Harrison Blake (1808–1899)	Secretary	1877
Simeon Borden (1798–1856)	President, vice president	–
Uriah Atherton Boyden (1804–1879)	– –	–
Ellis Sylvester Chesbrough (1813–1886)	Vice president, treasurer, director	1877
John Childe (1802–1858)	– –	–
Marshall Conant (1801–1873)	– –	–
Franklin Darracott (1820–1895)	Treasurer	1877
William Lee Dearborn (1812–1875)	Director	–
George Minot Dexter (1802–1872)	President, vice president	–
Sereno Dwight Eaton (1823–1899)	– –	–
Robert Henry Eddy (1812–1887)	– –	–
Samuel Morse Felton (1809–1889)	Director	1876
James Bicheno Francis (1815–1892)	President	1891
Charles Haynes Haswell † (1809–1907)	– –	1886
Waldo Higginson (1814–1894)	– –	–
Isaac Hinckley (1815–1888)	– –	–
Eben Norton Horsford ‡ (1818–1893)	– –	1852
Josiah Hunt (1818–1874)	– –	–
Martin Brimmer Inches (1820–1893)	Librarian	–
Samuel Francis Johnson (1821–1883)	– –	1877
James Laurie (1811–1875)	Director	–
Henry Swasey McKean (1810–1857)	– –	–
Samuel Nott (1815–1899)	Secretary, director	1891
George Alanson Parker (1822–1887)	– –	1877
William Pearce Parrott (1810–1868)	Vice president, treasurer	–
Thomas Willis Pratt (1812–1875)	– –	–
Theophilus E. Sickels (1822–1885)	– –	1877
Luciah Tilton (1811–1877)	– –	–
William Scollay Whitwell (1809–1899)	Director	1877
Thomas Scott Williams (1812–1874)	– –	–

---

* Includes all members of the early Society. Although a few of them were elected after the organization of the Society (July 3, 1848), they are all classed as founder members in this article.

† Corresponding member.

‡ Honorary member.

OFFICERS OF THE BOSTON SOCIETY OF CIVIL ENGINEERS, 1848–1874

NAME	President	Vice President	Secretary	Treasurer	Director	Librarian
Ashburner, Samuel	–	–	–	–	Mar. 5, 1850, to Mar. 22, 1852	–
Baldwin, James F.	July 3, 1848, to Mar. 25, 1850	–	–	–	–	–
Bennett, Joseph	–	–	–	–	July 3, 1848, to Mar. 22, 1852	Mar. 22, 1852, to Dec. 6, 1852
Blake, John H.	–	–	July 3, 1848, to Mar. 6, 1849	–	–	–
Borden, Simeon	Dec. 6, 1852, to Oct. 28, 1856	Mar. 25, 1850, to Dec. 6, 1852	–	–	–	–
Chesbrough, Ellis S.	–	Dec. 6, 1852, to Mar. 1, 1853	–	Mar. 1, 1853, to Oct. 1, 1855	July 3, 1848, to Mar. 22, 1852	–
Darracott, Franklin	–	–	–	June 8, 1874, to Aug. 7, 1874	–	–
Dearborn, William L.	–	–	–	–	Mar. 4, 1851, to Mar. 22, 1852	–
Dexter, George M.	Mar. 25, 1850, to Dec. 6, 1852	July 3, 1848, to Mar. 25, 1850	–	–	–	–
Felton, Samuel M.	–	–	–	–	Mar. 6, 1849, to Mar. 4, 1851	–
Francis, James B.	Apr. 27, 1874, to Aug. 7, 1874	–	–	–	–	–
Inches, Martin B.	–	–	–	–	–	Dec. 6, 1852, to Oct. 1, 1855
Laurie, James	–	–	–	–	July 3, 1848, to Mar. 5, 1850	–
Nott, Samuel	–	–	Mar. 6, 1849, to Aug. 7, 1874	–	July 3, 1848, to Mar. 6, 1849	–
Parrott, William P.	–	Mar. 1, 1853, to Mar. 4, 1868	–	July 3, 1848, to Mar. 1, 1853	–	–
Whitwell, William S.	–	–	–	–	July 3, 1848, to Mar. 22, 1852	–

and Constructing Railroads," by *Simeon Borden*, which was subsequently published in book form.

Boston's new water supply was then under construction, and papers on that project included "Construction of Beacon Hill Reservoir" and "Mode Adopted for Carrying Water to South Boston," by *Whitwell;* an excellent one on "Contracts," by *Chesbrough;* and "Use of Lead for Service Pipes," by *Blake*. *Borden* exhibited the base-line measuring apparatus which he had designed and used on the Trigonometrical Survey of Massachusetts, and *Conant* demonstrated his "Solar Attachment" for a compass. Mr. Kyan of London, a guest at one of the meetings, described the kyanizing process for preservation of timber. Other papers were devoted to subjects allied to civil engineering. Although not presented as a paper, *Bennett* translated D'Aubuisson's "Hydraulics," adapting it to British units, and dedicating it to the Society.

In the draft of the original by-laws it was proposed that "every member be *required* to present a paper, or make a gift of a scientific book, map, plan or model each year," but after much discussion this was amended to read that these "are desirable means of promoting the objects of the Society." An amendment to the by-laws in 1850 provided for a fine of 25 cents for tardiness and 50 cents for absence from a meeting unless the member was more than thirty miles away. This caused some dissatisfaction, and *Uriah A. Boyden* resigned as a result. In subsequent years this by-law, while never repealed, appears *not* to have been enforced. On April 24, 1851, the Society was incorporated by *George M. Dexter*, *Simeon Borden* and *William P. Parrott*, and "their associates and successors."

The entrance fee was twenty dollars; annual assessments were determined by the Board of Direction, the amount "not to exceed ten dollars." It is amusing to note that one of the founder members, who signed the constitution, never paid the entrance fee or any annual dues. Since he was fairly active in the affairs of the Society for many years it is assumed that this negligence was either "overlooked" or "condoned;" for that reason he has been included among the founder members of the Society in this article, which has been prepared after an interval of almost ninety years.

By 1850 the Cochituate Aqueduct was completed, and within a few years the amount of new railroad construction had lessened. The middle west, however, was developing rapidly, and civil engineers were in great demand. It is not surprising to find that many of Boston's engineers left the east to take advantage of these opportunities. Within a short period *Childe*, *Eaton*, *Felton*, *Hunt*, *Johnson*, *Laurie*, *Parker*, *Sickels* and *Tilton* were engaged in railroad work outside of New England; *Nott* and *Pratt* were in Connecticut; *Bennett* was in New York; and finally, *Chesbrough* left to take charge of the sewerage work in Chicago. For some time those who remained carried on the affairs of the Society, but with a gradually diminishing attendance. Finally it seemed best to suspend the activities, at least for a time. *Ashburner* and *Higginson* were appointed to take over the property of the Society, and in 1861 they deposited the library books and the Society's records with the Boston Athenæum.

The experience of our Society was much the same as that of the American Society of Civil Engineers which was founded in 1852 and held meetings for three or four years, then ceased its activities until 1867, when it was revived by *James Laurie*, its first president. In early engineering organizations the membership consisted to a large extent of those who had already reached positions of responsibility and prominence in the profession. Lack of encouragement of the younger men just entering the civil engineering profession to join and take an active part in the proceedings was undoubtedly one of the principal causes for the failure of these societies to become stronger in their early years. In the case of our own Society we shall see that a new group of young engineers, with the advantages of technical education and training, was to revive the organization, re-establish the library, and so conduct its affairs that today it occupies an honored position in the engineering world.

Other Early Civil Engineering Societies

Institution of Civil Engineers

The rise of civil engineering in England and its establishment among the professions may be traced through the careers of John Smeaton (1724–1792) and Thomas Telford (1757–1834); there were, of course, other civil engineers of prominence during these years, among them such men as Brindley, Jessop and the two Rennies. The period from 1750 to 1800 witnessed much activity in the industrial life of England, with the consequent demand for the development of roads, rivers, harbors and canals. The men responsible for carrying out these internal improvements were self-created, many of them being artisans and mechanics of unusual ability. Smeaton, who was probably the first to use the title of Civil Engineer, was a maker of scientific instruments in his early years. His marked ability soon led him into new fields, and he was chosen to build the Eddystone Lighthouse, an important task and perhaps his greatest work. Following this he devoted his life to the construction of roads, bridges and canals, and the improvement of harbors. Scarcely an important project in this period was carried out without his advice being sought. Those engaged in this new profession felt the need of better acquaintance in order to discuss their common activities, and in 1771 an informal organization was established to accomplish this purpose. During the next twenty years about sixty-five persons took part in these meetings, of whom only about fifteen could be classed as real engineers, the others being scientists, artists and mechanics. In 1792 some dissension arose which caused a break in the meetings; it was later decided to renew the society, but Smeaton died before this was accomplished. However, in 1793 a new organization was formed, known as the Smeatonian Society of Civil Engineers. It consisted of ordinary members who were engineers, and honorary members who were men of science and gentlemen of rank and fortune interested in civil engineering, and artisans whose professions were useful to civil engineers.*

Although this society continued its existence † it became evident that it was too exclusive to meet the needs of so large and mixed a body of men as had become engaged in the civil engineering profession. As a result in 1817 a group of young engineers decided to form a society having for its object "the furtherance of professional knowledge." This group held its first meeting on January 2, 1818, at the King's Head tavern in Cheapside, and adopted rules which, with some modifications, served as the basis of the Institution of Civil Engineers as later incorporated. After meeting for two years without any considerable increase in membership the society voted to extend its provisions to include the election of a president "whose extensive practice as a civil engineer has gained him the first-rate celebrity; and that a respectful communication be made to Thomas Telford, esquire, civil engineer, to patronize the Institution by taking upon himself the office of President."

Telford, who was of humble birth, had been in his early years apprenticed to a stone mason. In this work he had become expert and was soon in charge of important building projects and was also county surveyor of Salop, a position he held until his death. Bridge building first claimed his attention, but he soon became active in canal construction and his services were required by the crown and by foreign powers. He later was associated with harbors and fisheries on the northern coast

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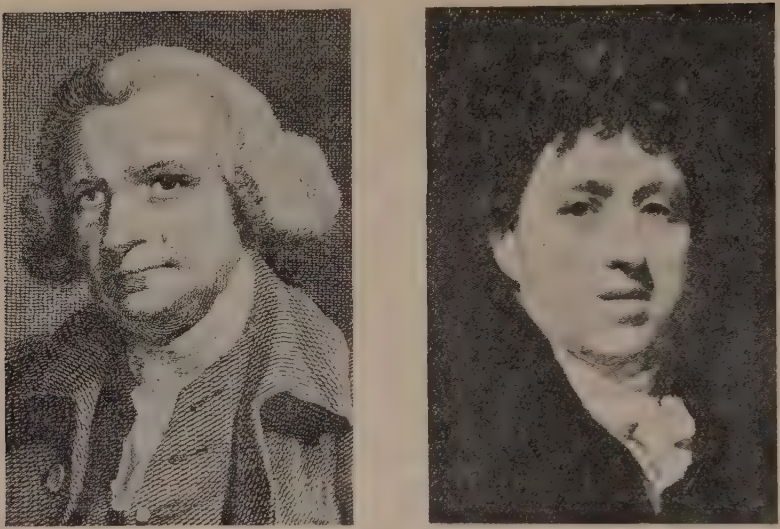
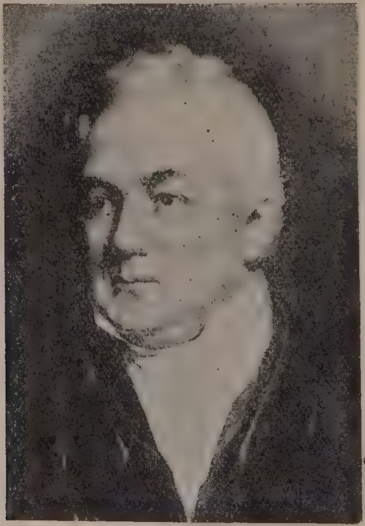
* This Society published "Smeaton's Reports," a noteworthy contribution to the profession of civil engineering.

† In "The Story of Telford" (1935) Sir Alexander Gibb states that this organization still exists as a "select dining club."



John Smeaton
1724–1792

Thomas Telford*
1757–1834



Loammi Baldwin
1780–1838

Fig. 2. — Noted Early Civil Engineers

From a portrait by Sir Henry Raeburn in the Lady Lever Art Gallery, Port Sunlight, England of Scotland, docks at London, and was responsible for a great system of roads and bridges by which whole regions were brought together. Although a member of the Smeatonian Society of Civil Engineers, Telford had apparently never been associated with the newer society until invited to become its president. Appreciating its value and the useful results it was capable of yielding, he accepted and was formally installed soon after. With this new impetus the organization grew rapidly, and on June 3, 1828, it received a charter of incorporation with its present title. A few years later Telford gradually withdrew from active practice and gave increased attention to the affairs of the Institution, which he endowed with a munificent bequest. This organization, so firmly established under Telford's direction, has had a continuous record of achievement and now stands in the front rank of engineering societies.

Société des Ingénieurs Civils de France

On March 4, 1848, a few months before the establishment of the Boston Society of Civil Engineers, a group of French civil engineers founded the Société des Ingénieurs Civils de France. Earlier attempts had been unsuccessful owing to the different viewpoints of engineers in government service and of those in private employment. However, a group of the most prominent civil engineers of that country succeeded in the establishment of a society in 1848 whose purpose was to unite the members of the profession and to give them an opportunity for technical discussion. For its first president, after the permanent organization was effected, M. Eugène Flachat, a noted railroad engineer, was chosen, and he served with distinction for many years. The society has had a steady growth in numbers and usefulness to the profession from the date of its foundation to the present time.

American Society of Civil Engineers

On November 5, 1852, a small group of civil engineers met in the office of Alfred W. Craven, chief engineer of the Croton Aqueduct for the city of New York, and formed the "American Society of Civil Engineers and Architects." Of the twelve men present at this meeting *James Laurie*, who had been active in the founding of the Boston Society of Civil Engineers four years earlier, took a prominent part. He presented a draft of a constitution which he had prepared.† *Laurie* was elected president of the Society and served for fifteen years, until the reorganization of the Society.

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* The early history of the Institution is given in *Transactions*, Institution of Civil Engineers, vol. I.

† This draft, which served as the basis of that Society for many years, was very similar to the original constitution of the Boston Society of Civil Engineers.

Meetings were held until March 2, 1855, after which it was found impossible to carry on the activities of the Society. The experience of the American Society in this respect was much like that of our own Society. This inactivity continued until 1867, when through the efforts of *Laurie* the Society was resuscitated. During the next year the name was changed to the American Society of Civil Engineers. The Society has enjoyed a continuous record of advancement and prosperity since that time.* Although *Laurie* was the only B. S. C. E. founder member who took part in the organization meeting of the American Society of Civil Engineers, the names of others are found on the rolls of the American Society: *Chesbrough*, *Dearborn*, *Dexter*, *Felton*, *Francis*, *Haswell*, *Higginson*, *Hunt*, *Inches*, *Parker*, *Parrott*, *Pratt* and *Sickels*. *E. S. Chesbrough* and *James B. Francis*, as well as *James Laurie*, served as presidents of the American Society of Civil Engineers.

Western Society of Engineers

The third engineering society in America was the Civil Engineers Club of the Northwest, established in 1869 in Chicago. This society was based on the broad meaning of the words "civil engineer," and included in its membership engineers of all branches. In 1880, with the growing recognition of other branches of engineering as distinct from civil engineering, the name of the organization was changed to the Western Society of Engineers. The Society as now organized has exerted an important influence on engineering in that section of the country for more than half a century. Although none of the B. S. C. E. founder members took part in the organization meeting of the Civil Engineers Club of the Northwest on May 25, 1869, it is interesting to note that *E. S. Chesbrough* joined at an early date and served as its president for several years.

EDUCATION AND TRAINING OF EARLY CIVIL ENGINEERS

The object of this paper is twofold, — to sketch briefly the early history of the Society, and to view the professional careers of its Founders. Before presenting the "high lights" of the careers of these men, it seems appropriate to describe the educational opportunities available in this period and to show the type of work going on at the time of the establishment of the Society.

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* Other national engineering societies were founded in the following years: American Institute of Mining and Metallurgical Engineers, 1871; American Society of Mechanical Engineers, 1880; and the American Institute of Electrical Engineers, 1884.

Opportunities for formal education in civil engineering were very limited prior to 1850. In fact, *Professor Horsford*, who was associated with the Society as an honorary member, was the only one of this group to receive a degree in civil engineering (Rensselaer, 1838).* *Parrott* graduated from Norwich University † in 1825, where he studied mathematics and the natural sciences, and doubtless obtained some knowledge of civil engineering. *Pratt* attended Rensselaer for a few years but did not complete the course. *Captain John Childe*, who graduated from the United States Military Academy at West Point in 1827, received an excellent grounding in mathematics and science as well as some civil engineering training. A number of the early graduates of West Point entered civil life and became prominent in engineering, particularly on railroad location and construction.‡

The middle of the nineteenth century marked the beginnings of several well-known scientific and technical institutions and the establishment of civil engineering courses in existing colleges. The Lawrence Scientific School (at Harvard) and Sheffield Scientific School (at Yale) were both organized in 1847. Courses in engineering were apparently established at Union College in 1845 and at Brown University in 1849. Although our founder members had few opportunities themselves to study civil engineering at college, the Society was organized just at the time when the need for this type of education had become recognized. Although the Massachusetts Institute of Technology was not incorporated until 1861,§ and classes actually started in 1865, it is of unusual interest to learn that its founder, William Barton Rogers, had seriously considered the establishment of a Polytechnic School in Boston a quarter of a century earlier, but gave up the plan at that time.||

Loammi Baldwin, often referred to as "the Father of Civil Engineering in America," was in large measure responsible for the sound practical training received by many civil engineers in New England. Although originally planning to become a lawyer, his interest in the natural sciences soon convinced him that he should devote his talents

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* Rensselaer Polytechnic Institute was founded in 1824 at Troy, N. Y.; one of its purposes was the qualification of teachers of science. In 1828 civil engineering subjects were first included in its lectures, and the course in civil engineering was established in 1835.

† Established at Norwich, Vt., in 1819 by Alden Partridge. It was known as the American Literary, Scientific and Military Academy (or, colloquially, as Partridge's Military Academy) until its incorporation as Norwich University in 1834.

‡ Among these were G. W. Whistler, W. G. McNeill, W. H. Swift and John Childe.

§ *James B. Francis*, *William P. Parrott* and *Eben N. Horsford* were included among the incorporators.

|| "Life and Letters of William Barton Rogers."

to the then little-known profession of civil engineering. After a trip abroad to inspect the public works of Europe he opened an office in Charlestown, Mass., and in the short span of his professional career (less than thirty years) he became the most noted civil engineer of that era.* He took into his office as students a number of young men whom he trained in physics, mathematics, surveying and kindred subjects. These students or apprentices served as his assistants in the field and office as their education progressed. For this training they paid $200 per year, and they received a modest compensation while assisting in his professional work. Among these were *Boyden*, *Dexter*, *Eddy*, *Felton*, *Higginson*, *Johnson*, *McKean* and *Parker;* probably other members of the B. S. C. E. group were also enrolled, but substantiating records are not available. *Samuel M. Felton*, while studying civil engineering there, served as an instructor of mathematics and the sciences. After Loammi Baldwin's death, *Felton* took over the office and much of the professional practice; some of the younger members, including *Johnson* and *Parker*, remained as students with him. A few of Baldwin's students had previously received an A.B. degree at Harvard (*Felton*, *Higginson* and *McKean*); *Dexter* and *Hinckley* had attended Harvard but had not finished, owing to poor health.

The training of these men under *Baldwin* and *Felton* assured them not only a sound civil engineering education, but it gave them unusual opportunities to secure positions as their capabilities developed. Although his death occurred nearly a decade before the Boston Society of Civil Engineers was organized, any history of the Society would be incomplete if it failed to give to Loammi Baldwin a large measure of credit for his influence on the civil engineering of that formative period.

Most of the other members of the founder group received the equivalent of a high school education, after which they engaged in civil engineering activities and gained their knowledge of the profession through practical experience supplemented by earnest study on their own initiative.† It is an interesting fact that the two men who became most prominent in the field of hydraulics and sanitary engineering, and served as presidents of the American Society of Civil Engineers, received almost no schooling beyond the elementary grades — these men were *Francis* and *Chesbrough!*

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* For a more detailed account of Loammi Baldwin's career, see p. 183.

† The professional biography of *Thomas S. Williams* (p. 222) furnishes a typical example of this self-training.

OPPORTUNITIES FOR CIVIL ENGINEERS IN 1848

While the opportunities for obtaining a civil engineering education, as we now conceive it, were limited, the demand for men capable of carrying out engineering projects was great. The period from 1830 to 1850 was one of rapid development in New England, and the number of civil engineers was small.* The era of canal construction had ceased abruptly with the advent of the railroad. In 1825 Loammi Baldwin had reported on a proposed canal from Boston to the Hudson River, but three years later all thoughts of a canal were abandoned, and his brother, *James F. Baldwin*, was engaged to make surveys for a railroad across the State. Within the next two or three years charters were obtained for railroads from Boston to Lowell, to Worcester, and to Providence; by 1835 these three roads were all in operation. Additional lines were built in rapid succession in Massachusetts, Rhode Island and Connecticut, and soon after in the northern New England States. In the twenty-year period (1835–55), the railroad mileage increased in Massachusetts from 50 to 1,200, and in New England as a whole from 50 to 3,500. This intensive railroad development provided a fertile field of employment, and at least twenty-eight of the thirty-one regular members of the Society were on railroad work at some stage in their careers. At least ten of them devoted their lives to this work, occupying positions of importance in railroad engineering, operation and management.

The development of Boston's first public water supply from Long Pond is very closely allied to the Society's early activities.† For twenty years there had been agitation for a public supply. Loammi Baldwin, and later his brother, *James F. Baldwin*, recommended Long Pond as a source, while others, including *R. H. Eddy*, advocated near-by ponds north of Boston. Finally, in 1846, the Cochituate gravity scheme was adopted and *James F. Baldwin* named as one of the commissioners. *Chesbrough* was made chief engineer of the aqueduct section from Framingham to the Brookline reservoir, and *Whitwell* was chief engineer of the section from Brookline to Boston, which included reservoirs at Beacon Hill and South Boston and the distribution system. *Williams*, *Sickels* and *McKean* served as resident engineers on the aqueduct, and *Conant* was an assistant under *Sickels*. Ground was broken with appropriate ceremonies at Long Pond (at this time renamed Lake Cochituate) on August 20, 1846.*

---

* The Massachusetts Census of 1850 showed 68 civil engineers and 106 surveyors.

† "History of the Introduction of Pure Water into Boston" contains a complete account of the project.

Rapid progress was made in the construction of the aqueduct, and on October 25, 1848, a grand celebration was held on Boston Common with parades, bands and all the pomp of that period when the water was turned on at the fountain and rose "in a strong column, 6 inches in diameter, increasing rapidly in height, until it reached an elevation of 80 feet." In the final report on January 4, 1850, the commissioners stated:

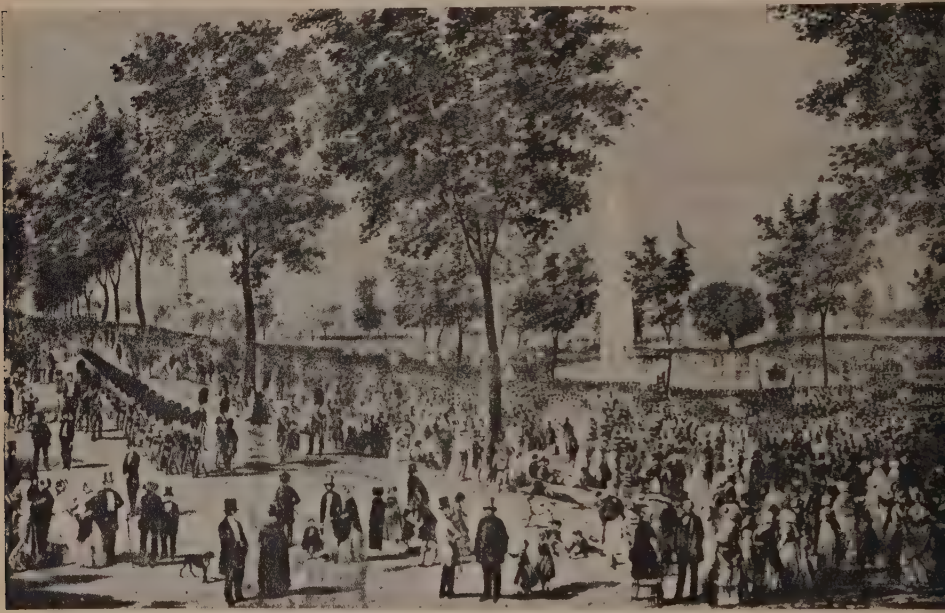

FIG. 3. — CELEBRATION ON BOSTON COMMON ON THE INTRODUCTION OF COCHITUATE WATER, 1848

> We feel bound to express our acknowledgments to the Chief Engineers, *William S. Whitwell* and *E. S. Chesbrough*, Esquires, for their very able services, for their most faithful and satisfactory discharge of the duties devolved upon them, and their constant devotion to the expeditious and thorough execution of the work in their respective departments.
>
> To their skill and efficiency we are greatly indebted for the successful completion of this great work.

---

* The author has found an entry in the cash book of his great grandfather, a musician and band leader, recording the payment for his services on that occasion.

Others were engaged in the development of water power needed by the growing textile industries along the Merrimack River. Little had been done in the design of improved water wheels and other hydraulic appurtenances up to this time. But with the entry of the civil engineers of this period rapid strides were made in the science of hydraulic engineering, and New England will always be noted for its celebrated hydraulicians, among the first of whom were *Francis* and *Boyden*. Other activities requiring civil engineers were taking place within the cities, — land and water-front development, roads and bridges, and the construction of gas works. Many opportunities existed for civil engineers to become associated with industrial enterprises, and in their later years a number of these men were eminently successful as presidents of railroads and street railways, fire insurance companies, steel plants, water power and land development projects, and manufacturing and commercial organizations.

New England Association of Railroad Superintendents

Closely connected with the early history of our Society and its members is that of the New England Association of Railroad Superintendents, which, like our own Society, was the first organization of its kind in the United States (perhaps in the world). On April 5, 1848, just three weeks before the first informal meeting of those interested in organizing a civil engineering society, a group of railroad superintendents, including *Felton*, *Higginson*, *Hunt* and *Tilton*, met at the Revere House and laid plans for establishing this railroad association. *Parrott* was soon after elected an associate member and made secretary, a position he held throughout the life of the organization. Other B. S. C. E. members to join were *Hinckley*, *Pratt*, *Johnson*, *Williams*, *Dexter* and *Ashburner*. *Tilton* served at one time as president and *Williams* as vice president.

The objects of the Association were "the increase and diffusion of knowledge upon scientific and practical subjects connected with railroads and the promotion of harmony among the railroads of New England." The most important activities of the Association were the study of railway equipment and the investigation of patented appliances, preparation of operating rules and publication of a Railway Gazette. Many of the activities were closely allied with those of our Society, and later the two organizations occupied adjacent rooms, with a library in common (located at 11½ Tremont Row). With the expansion of the railroads to the west, many of the superintendents who had been active in the group left New England for positions of greater responsibility in the development of these new railroads. Finally, on October 1, 1857, it was voted to dissolve the organization.*

Boston Railroad Jubilee, 1851†

The rapid development of railroads in New England from 1830 to 1850 has already been noted. The completion of the Vermont Central R.R. in 1851, finally opening a new route to Canada and the west, was the signal for a great Railroad Jubilee in Boston. The city government arranged for a three days' celebration with noted guests from United States and Canada, and with eminent speakers, including Millard Fillmore, president of the United States. Space does not permit a description of the festivities, — parades, banquets and speeches, — but one feature of interest may be noted. On the second day of the celebration (September 18, 1851) about two hundred guests, including President Fillmore, went by train from the Boston & Maine R.R. station to the new terminus of the Grand Junction R.R. at East Boston, where, with appropriate ceremonies, the formal opening of this terminal railroad and wharf company took place. *William L. Dearborn*, one of the directors of the Society, was chief engineer of the Grand Junction R.R., and *Samuel Nott*, our secretary, had made the surveys for this line.

"High Lights" in Careers of Founder Members

The preparation of the Professional Biographies of all the members of the early Boston Society of Civil Engineers has involved much correspondence and research over a period of several years. These are published in full as a separate part of this paper. It is realized, however, that they contain more detail than may be of general interest, and it has therefore seemed appropriate to include the following brief résumé of the "high lights" in the careers of these men:

Josiah Hunt and *Lucian Tilton* are typical cases of New England engineers who went to the middle west and became influential in railroad affairs. They both worked on the construction of early Massachusetts railroads, and were superintendents here in 1850. *Hunt* later became chief engineer of the Great Western (of Illinois) R.R., chief engineer and land agent of the Hannibal & St. Joseph R.R., and director of many other lines. He was president of a bank and four times mayor of Hannibal, Mo. *Tilton* was chief engineer and superintendent of the Toledo, Wabash & Western R.R., president of the Great Western (of Illinois) R.R., director of the Illinois Central R.R., and vice president of the North Chicago Ry.

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* In 1910 the Eastern Railroad Association, which had received the original records of the New England Association of Railroad Superintendents from Mr. Parrott's widow, published them for distribution to its members.

† "The Railroad Jubilee — An Account of the Celebration Commemorative of the Opening of Railroad Communication between Boston and Canada, September 17, 18 and 19, 1851."

Another group devoted their lives to railroad location and construction. *Captain John Childe*, a West Point graduate, built much of the Western (now B. & A.), Troy & Albany, Ohio Central, and Mobile & Ohio Railroads. His services were widely sought throughout the country. *Sereno D. Eaton*, after working on the Old Colony R.R. went to Iowa where he was engineer of the Keokuk, Fort des Moines & Minnesota R.R., Hannibal & Naples R.R., and other lines of the C. B. & Q. system, and during his later years a contractor for heavy steam shovel work on railroad construction. *Samuel F. Johnson* was division engineer on the Fitchburg R.R., engineer and superintendent of the Vermont & Massachusetts R.R., chief engineer of the Chicago, St. Paul & Fond du Lac R.R., and chief engineer of railroads in Texas. Returning to New England he built parts of the Old Colony and the Portsmouth & Dover Railroads. *George A. Parker* was engineer on the Concord R.R., chief engineer of the Sullivan R.R., and superintendent and acting president of the Philadelphia, Wilmington & Baltimore R.R. He built a two million dollar bridge across the Susquehanna. Returning to New England he built the Lancaster R.R. and served in the Massachusetts legislature. His son is Herbert Parker, for many years Attorney General of Massachusetts, and his granddaughter, Katherine V. Parker, is now a member of the Massachusetts legislature.

Theophilus E. Sickels served on the Croton Aqueduct, was resident engineer under *Chesbrough* on the Cochituate Aqueduct, then became chief engineer of the West Chester & Philadelphia and of the Philadelphia & Baltimore Central Railroads. Later he was chief engineer of the Hannibal & St. Joseph R.R., then chief engineer and general superintendent of the Union Pacific R.R., and built the first bridge across the Missouri River at Omaha. He also acted as a consulting engineer for railroads throughout the country.

Another group included *Felton*, *Hinckley* and *Nott*. *Samuel M. Felton* was chief engineer and superintendent of the Fitchburg R.R., and president of the Philadelphia, Wilmington & Baltimore R.R. during the trying years of the Civil War. He arranged for Abraham Lincoln's famous surprise trip by night through Baltimore to take office as president. Later, after regaining his health following a break-down as the result of his strenuous work during the war, he became president of the Pennsylvania Steel Company. *Isaac Hinckley* was superintendent of the Providence & Worcester R.R., agent of the Merrimac Manufacturing Company, and on *Felton's* retirement he became president of the Philadelphia, Wilmington & Baltimore R.R., a position he held for over twenty years. *Samuel Nott* started railroad work on the Boston & Worcester R.R. in 1835, was division engineer on the Eastern R.R., and later located and built many other railroads in New England. In 1855 he became superintendent of the Hartford, Providence & Fishkill R.R., holding this position for more than twenty years. He was secretary of the Society for almost its entire early period of activity.

The names of *James Laurie* and *T. Willis Pratt* are closely associated. Both were on the construction of the Norwich & Worcester R.R., which probably included the first railroad tunnel in America. They both served on many railroad lines between New York and Boston and were experts on bridge construction. *Laurie* built the bridge across the Connecticut River at Warehouse Point, perhaps his greatest work. *Pratt* will always be remembered for the truss that bears his name; he was also an inventor of various railroad mechanical improvements. He built the bridge for the Eastern R.R. at Newburyport in 1867, replacing the first bridge built there by *Nott* in 1840.

Ellis S. Chesbrough was the outstanding engineer of this period in the field of waterworks and sewerage. After eighteen years in railroad work he became chief engineer of the western end of the Cochituate water supply project, later served as water commissioner, and was Boston's first city engineer. In 1855 he went to Chicago where for over twenty years he was in charge of sewerage, water supply and other public works. He served as consulting engineer for important projects throughout the country, including a sewerage report for Boston in 1876. He was one of the most active members of the Society and probably largely responsible for founding it.

The names of *Francis* and *Boyden* will always be associated with water power development in New England. *James B. Francis* became engineer of the Locks and Canals at Lowell at the age of twenty-two, serving as engineer, agent and consulting engineer for that corporation for over fifty years. He was responsible for the improvement of the Howd type of water wheel, which now bears his name. In 1855 he published his "Lowell Hydraulic Experiments," a notable treatise. *Uriah A. Boyden* invented the hook gauge and the diffuser, and improved the Fourneyron turbine which now bears his name. He became financially independent through his inventions, and devoted much of his later life to research in the sciences.

Simeon Borden is best known for his Trigonometrical Survey of Massachusetts. His services were also widely sought as an expert witness on mechanical inventions. In 1930 a mountain in the Savoy State Forest was given his name, in honor of his survey of Massachusetts.

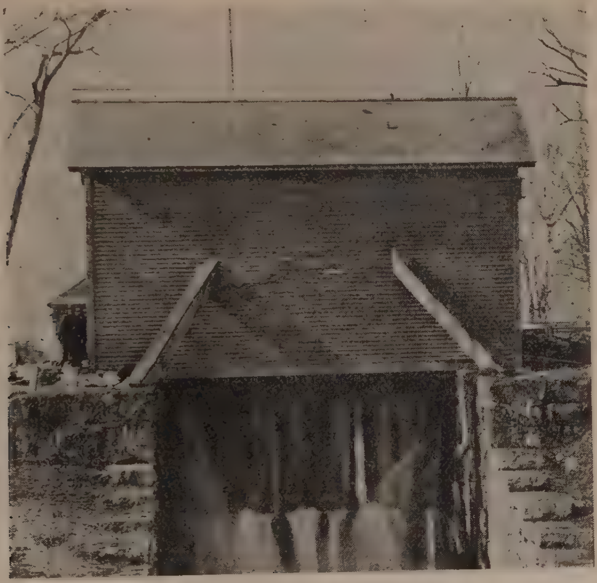

FIG. 4. — FRANCIS' "FOLLY"

In 1848, *James B. Francis*, engineer for the Proprietors of Locks and Canals on the Merrimack River, built an emergency gate near the head of one of the canals in Lowell, Mass. Many believed this structure unnecessary, and dubbed it *Francis*' "Folly." But his foresight was amply justified, because the gate was used in 1852, and again in the flood of March, 1936, it was closed, protecting the canals and a section of the city from inundation and great damage.

William P. Parrott was a civil engineer of whom little information had been published. His service to the New England Association of Railroad Superintendents has already been noted. After engaging in the shipping industry for a while, he followed civil engineering in Boston for twenty years, much of the time as a partner of *Nott* on railroad surveys, and later was president of the Vermont & Canada R.R. He also was active in the development of Boston's water front, the Back Bay and East Boston. He took a very prominent part in the affairs of the Society.

Samuel Ashburner was another civil engineer who spent most of his life in private practice in Boston, much of it devoted to consulting in the railroad field. Earlier he had been a division engineer on the construction of the Eastern R.R. At one time he was chief engineer of the Hartford, Providence & Fishkill R.R.

William L. Dearborn's career was divided between railroads and water supply. After locating and building railroads in various parts of New England, he became chief engineer of the Grand Junction R.R. Later he went to New York and for a number of years was in charge of important projects for the New York water supply, and at the time of his death was connected with the 4th Avenue Improvements in New York City.

Robert H. Eddy was a man of diverse talents. His early work was as engineer for the East Boston Land Company, where he developed much of that property. Later he became a solicitor of patents, probably the first to establish that profession in this country.

Bennett, *McKean* and *Conant* were civil engineers and surveyors in Boston, all of whom possessed literary talents, and in a later generation might have devoted themselves to that field rather than to that of civil engineering. *Joseph Bennett* was on early railroad work, later on the Brooklyn Water Works and on surveys for increased power on the Merrimack River. He translated several technical books, took great interest in the Society's library, and contributed articles to various publications. *Henry S. McKean* was a teacher and a librarian at one time, then a resident engineer on the Boston water supply, and assistant city engineer. After that he went into private practice, but was considering a change to literary pursuits at the time of his death. *Conant* edited numerous astronomical publications, was a surveyor on the Boston water supply, and later became principal of the Bridgewater Normal School.

James F. Baldwin, builder of the Boston & Lowell R.R., served as a commissioner for the construction of the Cochituate water supply. After its completion most of his interests were outside the engineering field, in connection with mills and industrial properties; he also served as state Senator and on many boards.

William S. Whitwell, chief engineer of the Boston distribution system of the Cochituate water supply, was for some years a partner of J. B. Henck in civil engineering practice. He later was treasurer and president of the Boston Water Power Company and managing treasurer of the Boston & Roxbury Mill Dam Corporation.

John H. Blake and *Franklin Darracott* were in partnership for many years building gas plants throughout New England. In his earlier years *Blake* had been in chemical practice. Later he was active in street railway development and served as president of the Middlesex and Metropolitan Companies, as well as carrying on other interests. *Darracott* later went to New York City where he served as vice president of the Nason Manufacturing Company, a firm dealing in valves, steam heating fittings and sanitary supplies.

George M. Dexter and *Waldo Higginson* served as agents (managers) of the Boston & Lowell R.R. *Dexter* was also interested in architecture and had much to do with the development of buildings in Scollay Square. Later he was treasurer and for a time president of the Vermont Central R.R., as well as having numerous other interests. *Higginson* in later years was the founder and for a long time president of the Arkwright Mutual Fire Insurance Company, being a pioneer in this field.

Thomas S. Williams had a varied career. He was resident engineer on the Cochituate Aqueduct, superintendent of the Boston & Maine R.R., and later a partner for many years in the firm of Williams & Page, dealers in railroad supplies.

Martin Brimmer Inches is somewhat of an enigma. Nephew of Martin Brimmer, who was mayor of Boston, and a member of a family having important commercial interests, he was interested in civil engineering, took part in railroad surveys, and reported on water supplies in his early years. All attempts to get detailed information as to his later life have been unsuccessful.

Prof. Eben N. Horsford, the only honorary member of the early Society, was the founder of the Lawrence Scientific School at Harvard, and later founded the Rumford Chemical Works. *Charles H. Haswell*, the only corresponding member, was an eminent civil and marine engineer of New York City. He was well known as the author of the "Engineers and Mechanics Handbook," a standard for nearly sixty years. He was active in engineering almost until his death at the age of ninety-eight.

"JUNIOR" B. S. C. E. OF 1873

The early Society suspended its activities and deposited its library with the Boston Athenæum in 1861, and for the next ten years apparently no steps were taken by civil engineers in Boston to meet together for the discussion of matters of professional interest. The Massachusetts Institute of Technology, incorporated in 1861, had postponed its actual opening during the war period, but in 1865 classes were started and the first students graduated in 1868. During the next few years a new generation of civil engineers was becoming established in Boston. One of the most active of these was Ernest W. Bowditch, M. I. T. 1869, who had opened an office as topographical engineer and surveyor. On May 24, 1873, he wrote to about forty young men in the vicinity of Boston proposing "to form a junior 'Engineers' Association to meet at certain times and places for the purpose of consulting and discussing whatever topics of interest may be suggested, connected with engineering."

In response to this call, twenty-six persons met at the Massachusetts Institute of Technology on May 30, 1873, and agreed to form a society, the name of which was then suggested as the "Boston Engineers' Club." At a second meeting, held to consider the report of the committee on constitution and by-laws, Article I was presented, reading as follows: "This association shall be known as the Boston Society of Engineers." But "after considerable discussion" and on motion of Desmond FitzGerald it was amended to read "Boston Society of *Civil* Engineers!" The name of Desmond FitzGerald has long been an honored one in our Society; many of us were privileged to know him as a skilful engineer, an art collector of note, a generous contributor to our Society, and a past-president and honorary member. What has probably never before been realized is the fact that through his action in urging the name "Boston Society of *Civil* Engineers," the link was thereby established, however unwittingly, which provides our Society with its direct lineage from that group of earnest engineers who, in 1848, founded what is now the "oldest engineering Society in the United States."

With the characteristic enthusiasm of youth, additional articles of the constitution were discussed, amended and adopted, and on that same day, just a week after the preliminary meeting, the new society was under way with the following officers elected: president, Desmond FitzGerald; vice presidents, Henry Manley and Ernest W. Bowditch; secretary, George S. Rice; and treasurer, Robert H. Richards. This was indeed a group of young men; of the sixty-two names signed to the constitution within the next few months at least twenty were graduates or former students of Technology, an institution which had graduated its first class only five years previously. In fact, several were apparently students there at the time. At the next two meetings the remaining articles of the constitution and by-laws were adopted, an agreement secured with the Boston Public Library for the use of engineering books by the members of the Society, and arrangements made with the Institute for the use of a room. During the next few months meetings were held regularly and a number of papers presented.

On June 27, 1873, the Executive Committee had been instructed to find what steps would be necessary "to render the society legally capable of holding property and of having an exclusive right to its name." In carrying out these instructions, the committee soon learned that a society bearing the same name, which had been incorporated in 1851, still had a corporate existence — although then inactive. Prompt steps were taken looking toward a "union of the societies and possession of literary property of the corporated society."

E. W. Bowditch got in contact with the members of the incorporated Society of whom about ten were living near Boston. George Morrill, Justice of the Peace, issued a warrant authorizing *T. Willis Pratt*, *Waldo Higginson* and *Franklin Darracott* to call a legal meeting of the corporation. Pursuant to this warrant a meeting was held on April 27, 1874, at which *Francis*, *Higginson*, *Darracott*, *Pratt* and *Nott* of the original Society were present. *James B. Francis* was elected president and *Samuel Nott*, clerk and secretary. The names of the members of the Junior Society (B. S. C. E. of 1873) were then proposed for membership in the incorporated Society, and *Higginson* and *Pratt* were appointed a committee to reclaim the property which had been deposited with the Boston Athenæum. On June 8, 1874, another meeting was held at which the members of the Junior Society, proposed at the previous meeting, were elected to membership. Thus was established that direct link which provides our Society with its continuous legal existence! Many years later the Society voted that the names of those, then living, who took part in reorganizing the Society on June 8, 1874, should be listed separately on the membership rolls, and that they should be exempt from all dues. One by one death has removed the names from this List of Honor until now none are left who took part on June 8, 1874, and who have maintained continuous membership in the Society.* Prof. C. Frank Allen, past-president and honorary member, who joined the Society on March 24, 1875, is now our distinguished senior member and senior past-president, with a record of sixty-one years of continuous membership.

With the desired "union" accomplished, the older members retired from office, and the Society was turned over to this young and virile

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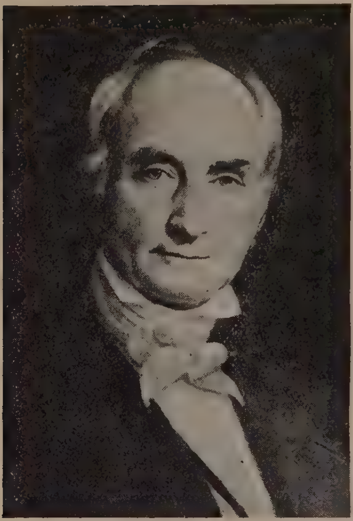
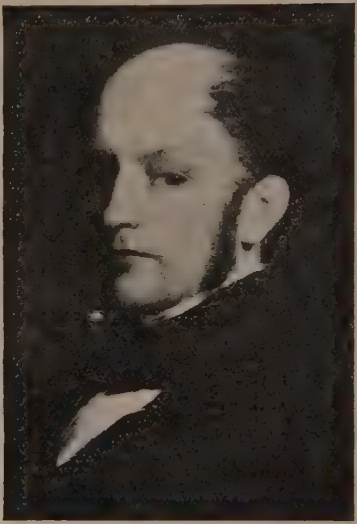
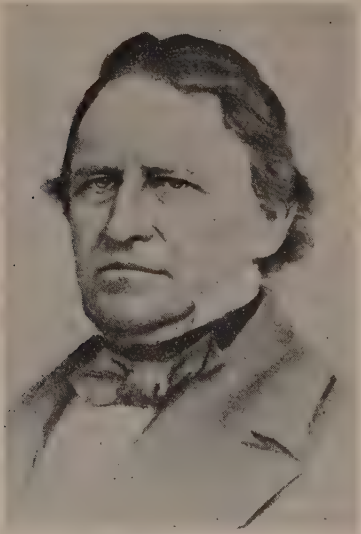
* Joseph F. Ross, a present member of the Society, was elected on June 8, 1874, but his membership has not been continuous since that time.



James F. Baldwin
1782–1862



George M. Dexter
1802–1872



Simeon Borden
1798–1856

FIG. 5. — PRESIDENTS OF EARLY SOCIETY, 1848–1856

group. Thomas Doane was elected president, an office which he held from 1874–79 and again from 1880–83. The other officers elected were: vice president, Desmond FitzGerald; secretary, George S. Rice; and treasurer, Clemens Herschel. Some difficulty was encountered in re-establishing a library with the books of the early Society, as many of these books had been catalogued and placed on the shelves of the Boston Athenæum Library. Apparently these had been considered by the Athenæum as a gift rather than as a deposit when they had been received in 1861.* An agreement was soon reached, however, by which the books which had not been incorporated in the catalogue of the Athenæum were returned, and the Society was reimbursed for the others.

In the annual report of the Board of Government on March 24, 1875, covering the activities of the reorganized Society for its first year, Thomas Doane, after reviewing briefly the history of the early Society, paid the following tribute to its Founders:

> Thus, gentlemen, we came to be.
>
> We succeed to a good name. As *juniors*, let us maintain the honor of that name, by conscientious work.
>
> We can boast of the blood of our ancestors, may its purity never be tainted.
>
> We are now brothers of one family, with a common name and inheritance. We have here a common hearth about which we shall be regularly asked to gather. We must each contribute something, at *least* our *presence*, to make these meetings both enjoyable and useful.
>
> We must deny ourselves often and sacrifice something to meet fully our obligations to this Society.

These were the thoughts of Thomas Doane sixty-one years ago; they could not be better expressed today! The Society has grown and prospered in the intervening years; our activities have expanded as the field of civil engineering has broadened. To the historian of our Centennial in 1948 will come the opportunity of carrying forward the annals of our Society and of honoring Thomas Doane and those other noted engineers who have followed him in the Boston Society of Civil Engineers, — the oldest engineering society in our land,— an organization of which we are justly proud!

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* A careful study of the correspondence between the early Society and the Boston Athenæum shows that a reasonable doubt might well have existed on this point.

PAST AND PRESENT OFFICERS

And Years in which they held Office

[The figures of the year during which the office was held are printed without those of the century. Except where shown otherwise by footnote, office was held from March of the year given to the following March. The names of deceased members are printed in *italics*.]

Name	President	Vice President	Secretary	Treasurer	Director
Adams, Henry S.	–	–	–	–	25–26
Allen, C. Frank	99	97–98	–	–	–
Allen, Charles M.	26	22–23	–	–	14–15
Ashburner, Samuel	–	–	–	–	[1] 50–52
Babcock, John B., 3d	35	32–33	22–28	–	30–31
Baldwin, James F.	[2] 48–49	–	–	–	–
Barbour, Frank A.	20	–	–	–	10–11
Barnes, T. Howard	–	99–00	–	–	–
Barrows, Harold K.	36	33–34	–	–	30–31
Bennett, Joseph	–	–	–	–	[3] 48–52
Bidwell, Lawson B.	01	–	–	–	–
Blake, Edmund M.	–	–	–	–	15–16
Blake, John H.	–	–	[4] 48	–	–
Borden, Simeon	[5] 52–56	[6] 50–52	–	–	–
Bowers, George	–	–	–	–	08–09
Brackett, Dexter	97	95–96	–	–	–
Breed, Charles B.	28	25–26	–	–	13–14
Brooks, Frederick	04	02–03	–	–	90–93
Brown, William M.	–	–	–	–	01–02
Bryant, Henry F.	10	08–09	–	–	–
Burden, Harry P.	–	–	–	–	33–34
Burton, Alfred E.	–	–	–	–	99–00
Cameron, Edward H.	–	–	–	–	28–29
Carson, Howard A.	98	–	–	–	–
Carter, Henry H.	–	94–95	–	–	–
Carty, John E.	–	–	–	–	20–21
Casagrande, Arthur	–	–	–	–	36
Chaplin, Winfield S.	–	–	–	–	[7] 90
Cheney, Herbert N.	–	–	–	–	22–23
Chesbrough, Ellis S.	–	[8] 52	–	[9] 53–55	[3] 48–52
Clapp, Otis F.	–	04–05	–	–	–
Coburn, Raymond W.	–	35–36	–	–	26–27
Coffin, Freeman C.	–	[10] 05–06	–	–	–
Crandall, J. Stuart	–	–	–	–	35–36
Curtis, Ralph E.	–	15–16	–	–	–
Darracott, Franklin	–	–	–	[11] 74	–
Davis, Joseph P.	[12] 80	77–79	–	–	–
Dean, Arthur W.	33	31–32	–	–	16–17
Dean, Francis W.	–	07–08	–	–	–

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[1] Mar. 5, 1850–Mar. 22, 1852.
[2] July 3, 1848–Mar. 25, 1850.
[3] July 3, 1848–Mar. 22, 1852.
[4] July 3, 1848–Mar. 6, 1849.
[5] Dec. 6, 1852–Oct. 28, 1856.
[6] Mar. 25, 1850–Dec. 6, 1852.
[7] Feb. 19, 1890–Mar. 18, 1891.
[8] Dec. 6, 1852–Mar. 1, 1853.
[9] Mar. 1, 1853–Oct. 1, 1855.
[10] Mar. 15, 1905–Nov. 11, 1906.
[11] June 8, 1874–Aug. 7, 1874.
[12] Mar. 17, 1880–Sept. 15, 1880.

Past and Present Officers — *Continued*

Name	President	Vice President	Secretary	Treasurer	Director
Dexter, George M.	[1] 50–52	[2] 48–49	–	–	–
Doane, Thomas	[3] 74–79 [4] 80–83	–	–	–	–
Dorr, Edgar S.	–	–	–	–	21–22
Dearborn, William L.	–	–	–	–	[5] 51–52
Eaton, Arthur C.	–	–	–	–	[6] 33–34
Eaton, Horace L.	–	–	[7] 82–87	–	–
Eddy, Harrison P.	14	–	–	–	–
Eddy, Harrison P., Jr.	–	–	–	–	27–28
Edwards, Athole B.	–	–	–	–	36
Ellis, John W.	05	–	–	–	–
Fair, Gordon M.	–	–	–	–	31–32
Farnham, Irving T.	–	–	–	–	[8] 07–08
Fay, Frederic H.	13	11–12	–	–	[9] 08–10
Felton, Samuel M.	–	–	–	–	[10] 49–51
Ferguson, John N.	–	–	–	–	13–14
Fernald, Clarence T.	–	–	–	–	17–18
FitzGerald, Desmond	88–89	[11] 74–76	–	–	–
Francis, George B.	09	–	–	–	02–03
Francis, James B.	[12] 74	–	–	–	–
Freeman, John R.	93	89–91	–	–	–
French, Alexis H.	00	98–99	–	–	–
Goodnough, X. Henry	–	01–02	–	–	98–99
Gow, Charles R.	15	13–14	–	–	11–12
Gunby, Frank M.	23	20–21	–	–	–
Haertlein, Albert	–	–	–	–	35–36
Hale, Richard A.	16	14–15	–	–	95–96
Hale, Richard K.	25	23–24	–	–	21–22
Hastings, Lewis M.	–	16–17	–	–	–
Herschel, Clemens	90	–	–	[13] 74–79	–
Hodgdon, Frank W.	06	00–01	–	–	96–97
Hollis, Ira N.	03	–	–	–	00–01
Horne, Ralph W.	32	30–31	–	–	28–29
Howard, John L.	–	–	–	–	18–19
Howe, Edward W.	07	–	–	92–05	–
Hutchins, Everett N.	–	–	29–36	–	–
Jackson, Dugald C.	22	–	–	–	–
Johnson, William S.	–	12–13	–	06–09	–
Kennison, Karl R.	–	36	–	31–35	–
Kimball, George A.	02	–	–	–	–
Laurie, James	–	–	–	–	[14] 48–50
Main, Charles R.	–	–	–	36	24–25
Main, Charles T.	11	09–10	–	–	06–07
Manley, Henry	92	–	–	80–91	93–94
Marston, Frank A.	27	24–25	–	–	22–23
McClintock, William E.	94	[15] 90–92	–	–	–

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[1] Mar. 25, 1850–Dec. 6, 1852.

[2] July 3, 1848–Mar. 25, 1850.

[3] Aug. 7, 1874–Mar. 17, 1880.

[4] Oct. 20, 1880–Mar. 19, 1884.

[5] Mar. 4, 1851–Mar. 22, 1852.

[6] Mar. 15, 1933–Mar. 6, 1934.

[7] Dec. 20, 1882–May 18, 1887.

[8] Mar. 20, 1907–Sept. 19, 1908.

[9] Nov. 18, 1908–Mar. 15, 1911.

[10] Mar. 6, 1849–Mar. 4, 1851.

[11] Sept. 4, 1874–Mar. 21, 1877

[12] April 27, 1874–Aug. 7, 1874.

[13] Sept. 4, 1874–Mar. 17, 1880.

[14] July 3, 1848–Mar. 5, 1850.

[15] Feb. 19, 1890–Mar. 15, 1893.

Past and Present Officers — *Concluded*

Name	President	Vice President	Secretary	Treasurer	Director
Metcalf, Leonard	19	06–07	–	–	04–05
Miller, Edward F.	–	–	–	–	05–06
Moore, Lewis E.	30	27–28	–	–	17–18
Moses, John C.	–	–	–	–	32–33
Nott, Samuel	–	–	[1] 49–74	–	[2] 48–49
Noyes, Albert F.	95	92–93	–	–	–
Parrott, William P. . . .	–	[3] 53–67	–	[4] 48–52	–
Philbrick, Edward S. . . .	–	80–83	–	–	–
Porter, Dwight	–	03–04	–	–	97–98
Rice, George S.	–	–	[5] 74–80	–	–
Rice, L. Frederick . . .	87	84–86	–	–	–
Rogers, Edwin H.	24	21–22	–	–	18–19
Rollins, James W.	12	10–11	–	–	–
Safford, Arthur T. . . .	34	28–29	–	–	23–24
Sampson, George A. . .	–	–	–	–	25–26
Sawtell, Harry E. . . .	31	29–30	–	–	26–27
Shaw, Arthur L.	–	–	–	–	29–30
Shepherd, Frank C.	–	–	–	–	27–28
Sherman, Charles W. . .	–	17–18	–	10–14	–
Snow, J. Parker	–	–	–	–	[6] 10–11
Spofford, Charles M. . .	18	–	–	–	12–13
Stearns, Frederic P. . . .	91	87–88	–	–	–
Street, L. Lee	–	–	–	–	[7] 10–12
Swain, George F.	96	93–94	–	–	91–92
Thompson, Sanford E. . .	–	–	–	–	16–17
Thorndike, Sturgis H. . . .	–	–	–	–	19–20
Tinkham, S. Everett . . .	–	–	[8] 80–82 [9] 87–21	–	–
Tuttle, Arthur S. . . .	–	–	–	–	19–20
Varney, Henry A. . . .	–	–	–	–	29–30
Vose, George L.	84–86	–	–	–	–
Waldron, Samuel P. . .	–	–	–	–	34–35
Walker, Frank B. . . .	–	–	–	–	34–35
Wason, Leonard C. . . .	–	18–19	–	–	14–15
Weston, Arthur D. . . .	–	34–35	–	–	31–32
Weston, Robert Spurr .	21	19–20	–	–	12–13
Whipple, George C.	17	–	–	–	15–16
Whitney, Frank O.	–	–	–	15–30	94–95
Whitwell, William S. . . .	–	–	–	–	[10] 48–52
Winsor, Frank E. . . .	29	26–27	–	–	24–25
Wood, Dana M.	–	–	–	–	23–24
Wood, Henry B.	–	–	–	–	20–21
Woods, Henry D.	–	96–97	–	–	–
Worcester, Joseph R. . .	08	–	–	–	03–04
Wright, Edward	–	–	–	–	32–33

[1] Mar. 6, 1849–Aug. 7, 1874.
[2] July 3, 1848–Mar. 6, 1849.
[3] Mar. 1, 1853–Mar. 4, 1868.
[4] July 3, 1848–Mar. 1, 1853.
[5] Aug. 7, 1874–April 21, 1880.
[6] Sept. 21, 1910–Mar. 20, 1912.
[7] Sept. 21, 1910–Mar. 19, 1913.
[8] April 21, 1880–Dec. 20, 1882.
[9] May 18, 1887–April 21, 1921.
[10] July 3, 1848–Mar. 22, 1852.

PROFESSIONAL BIOGRAPHIES OF THE FOUNDER MEMBERS OF THE BOSTON SOCIETY OF CIVIL ENGINEERS

Foreword

Winsor's "Memorial History of Boston," published in 1880, contained little mention of the part played by civil engineers in the development of Boston between 1830 and 1880. Within these five decades a complete network of railroads was built, gas works and street railways (horse-drawn) constructed, public water supply and sewerage systems laid out, water-front facilities improved, and much of the area within the heart of the city filled in and made available for business and commercial development. While some of these improvements were described in the 1880 memorial history, only occasional mention was made of the names of those civil engineers who were largely responsible for this important work.

In the section on "Engineers and Engineering" in the 1930 memorial history, "Fifty Years of Boston," Professor Charles M. Spofford included considerable material on those civil engineers who had received scant credit in the earlier history. At Professor Spofford's suggestion, the author, while secretary of the Boston Society of Civil Engineers, assembled some data about a few of the "1848" founder members of the Society who had taken a prominent part in the engineering activities of that period. In preparing this material the author's interest in the subject became so great that a new goal was set, — that of presenting a professional biography of each of the thirty-three engineers who belonged to the Society during the early period of its activity.

The foregoing statement explains the reason for preparing this set of biographies. For some of these men, the problem has been that of keeping the sketches within reasonable limits; for others the gathering of material has required a great deal of research and correspondence over a period of more than five years. In a few cases no information was available beyond the fact that they had been members of the Society; for these it was difficult to pick up the trail nearly a century later. Photographs of all but six of the founder members, secured from many different sources, appear in this article.

Those interested in genealogy will note the omission of data as to the descendants of the subjects of these biographies. It would be almost impossible to make such information complete after so many generations have passed. Since the professional careers of these men are of primary interest, it was decided not to include such genealogical data.

For some members of this group, memoirs had already been published, and it would have been possible to omit biographies of these men, giving instead references to the material presented elsewhere. It was finally decided, however, to present biographical records of all of the members so that this paper would be complete in itself. References are given at the end of each sketch to those publications which contain detailed information. Where no references are given the material has been obtained from sources of all kinds, including Society records, correspondence with direct descendants or those of collateral branches of the family, annual reports of railroads and other corporations, files of newspapers and technical journals, and probate court records. The names of all B. S. C. E. members are printed in italics in these biographies.

The author wishes to express his sincere appreciation of the cooperation and assistance of all those who have aided him in preparing these biographies.

SAMUEL ASHBURNER

(Born March 3, 1816; died June 9, 1891)

SAMUEL ASHBURNER, son of Luke Ashburner, a merchant of Stockbridge, Mass., was a division engineer on the construction of the Eastern R.R. and its extension, the Portland, Saco & Portsmouth, from 1837 to 1844. These two railroads were built in sections, each section being separated into three divisions under the supervision of *Ashburner*, *Samuel Nott* and Samuel Wilder, known as the three "Sams." When the first section was completed (East Boston to Salem), these engineers were transferred to the next three divisions (Salem to Newburyport), and so on through to Portland. From 1845 to 1851 *Ashburner* maintained an office in Boston and was engaged in surveys and construction of railroads in New England.

Later he became chief engineer of the Hartford, Providence & Fishkill R.R. This railroad, a consolidation of the Hartford & Providence and the New York & Hartford, had been authorized to build an east-west line across Connecticut. By 1852, the entire route from Providence, R. I., to Waterbury, Conn., had been surveyed, and he next made surveys for the westerly extension from Waterbury to the Hudson River, the field work being done by *Samuel Nott*, who later served as superintendent of the railroad for twenty years.

He returned to Boston about 1857 and opened an office for private practice which he maintained until 1875. He prepared several reports in 1866–67 on the Hoosac Tunnel, Troy & Greenfield R.R., which dealt with a proposed temporary railroad over the Hoosac ridge pending the construction of the tunnel. Little is known as to his later work; he apparently retired in 1875 and spent some of his remaining years in England.* In 1845 he had married Annie Meade Barstow, daughter of Dr. Gideon Barstow of Salem, Mass.

Samuel Ashburner attended the informal meetings which led to the founding of the Society, and was a member of the committee which framed the Constitution. He was a director from 1850 to 1852 and served on the library committee. He presented a paper upon "Carrying the Cochituate Water to East Boston by Means of a Tunnel Beneath the Harbor" which he prefaced with the statement:

> That he would disclaim any intention of proposing a plan of his own for carrying water to East Boston. An examination of every practicable means for the purpose has been the especial duty of some of the Society's most experienced members, and tunnelling beneath the harbor was no doubt amongst other methods considered by them.
>
> As, however, it is generally understood that plan is not to be adopted, and no report upon the question is published, it would seem not an improper subject of inquiry here, and it is to be hoped that the meeting will receive the benefit of a statement from Messrs. *Whitwell* and *Chesbrough*, of the views entertained by them in relation to this interesting section of the great work in which they are engaged.

He was a member of the New England Association of Railroad Superintendents and presented that organization with a model of a rail chair which he designed. The records indicate clearly that railroad work was the predominant feature of his career. No information is available as to his personality and individual characteristics.

JAMES FOWLE BALDWIN

(Born April 29, 1782; died May 20, 1862)

James Fowle Baldwin was the son of Loammi Baldwin (1745–1807), a Colonel in the Revolutionary Army and builder of the Middlesex Canal from Boston to Lowell.† Another son, Loammi Baldwin (1780–1838), was a noted civil engineer, and he has often been called the "father of civil engineering in America."‡ George R. Baldwin, a brother of James F. and Loammi, was also a civil engineer, and there have been civil engineers in each generation of descendants of the original Loammi Baldwin down to the present time.

After his education at academies in Billerica and Westford, *James F. Baldwin* worked with his brother, Loammi, who had an office in Charlestown, Mass. During the next twenty years, Loammi was engaged in civil engineering work of the greatest magnitude throughout the eastern part of the country. His work included such projects as the construction of Fort Strong (Boston Harbor), the Mill Dam (extension of Beacon Street beyond Boston Common), Union Canal in Pennsylvania, Bunker Hill Monument, and large dry docks at the Charlestown (Mass.) and the Norfolk (Va.) Navy Yards. While *James F. Baldwin* may not have been connected with all of these activities, it is certain that he worked on some of them.

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* His son, Walter Ashburner, who died in February, 1936, was educated in England and served as Professor of Jurisprudence at Oxford University.

† The "Baldwin" apple received its name from Loammi Baldwin, who was responsible for its development; he is said to have first seen this kind of apple when making surveys for the canal.

‡ An excellent biography of Loammi Baldwin (1780–1838), by George L. Vose, was published in the Journal of the Association of Engineering Societies, vol. V, p. 11.

In 1825 the legislature appointed a committee to consider a canal from Boston to the Hudson River, and Loammi, who was chosen to examine possible routes, prepared a report which included a tunnel at almost the same place where the Hoosac (railroad) tunnel was built later. The advent of the railroad, however, offered such attractive possibilities that attention was soon turned from canals to railroads, and in 1828 *James F. Baldwin* made an elaborate report for the State Board of Internal Improvements which included plans, profiles and estimates for various routes from Boston to the Hudson River. James Hayward made similar surveys for a railroad between Boston and Providence, R. I. By 1835 railroads had been built radiating from Boston to Lowell, Providence and Worcester. *James F. Baldwin* was chief engineer of the Boston & Lowell R.R. which had been organized through the action of the Proprietors of Locks and Canals on the Merrimack River at Lowell. The construction of this road was unusual, consisting of parallel masonry walls which supported stone cross-ties and "fish-belly" rails; however, this gave too rigid a structure and the walls were later removed. He was also engaged in the surveys of the Lowell & Nashua R.R., an extension of the Boston & Lowell.

For the next fifteen years, *Baldwin* took a prominent part in the studies and subsequent construction of the Boston water supply. From 1825 to 1837 there had been much agitation for the development of a satisfactory public water supply, and in 1834 Loammi Baldwin had reported on a project using Long Pond at Framingham as a source. Later *Robert H. Eddy* presented an alternate plan advocating the use of Spot and Mystic Ponds, near Boston. In 1837, *James F. Baldwin* served with Daniel Treadwell and Nathan Hale on a commission to report further on the subject. The majority report by Treadwell and Hale recommended Spot and Mystic Ponds which would require pumping, but *Baldwin* recommended a gravity supply from Long Pond. The controversy continued until 1846, when an aqueduct plan using Long Pond (now renamed Lake Cochituate) as a source was adopted — in essence the scheme advocated by *Baldwin* in his minority report nine years earlier.

James F. Baldwin, Nathan Hale and Thomas B. Curtis were appointed as commissioners to supervise the construction of the project, which was started promptly under the direction of *E. S. Chesbrough* and *W. S. Whitwell* as chief engineers, respectively, of the western division from Lake Cochituate to the Brookline reservoir and the eastern division from Brookline to Boston, including the distribution system. On October 25, 1848, water was introduced into Boston with an elaborate celebration on the Common; by 1850 the project was completed and the Commission abolished.*

The city of Boston was indebted to *Baldwin* for his foresight and professional skill in the development of a water supply which was not only adequate for the needs of the city at that time, but which was so planned that it could be expanded as the requirements increased. During the next decade *Baldwin's* activities were largely outside of the civil engineering field. He was connected with many industrial enterprises and served as State Senator and on many boards and commissions.

James F. Baldwin was elected president of the Boston Society of Civil Engineers at its organization on July 3, 1848, serving until March, 1850. In declining re-election he said:

> When joining the Society I intended to make known my inability to devote much time or attention to its transactions, and if, consistent with its rules, I can remain a humble member without office, I shall deem it a privilege and an honor to be called a fellow with those who compose this association.

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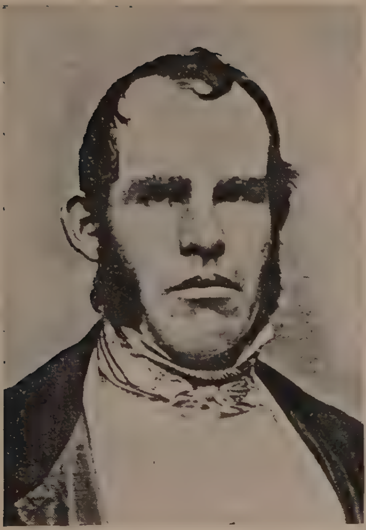
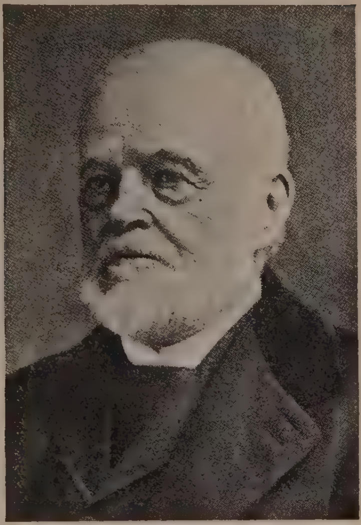
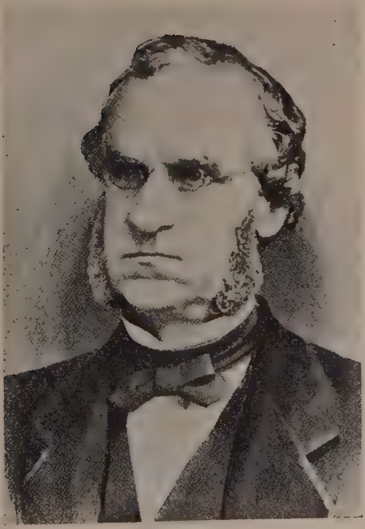
* "History of the Introduction of Pure Water into Boston."



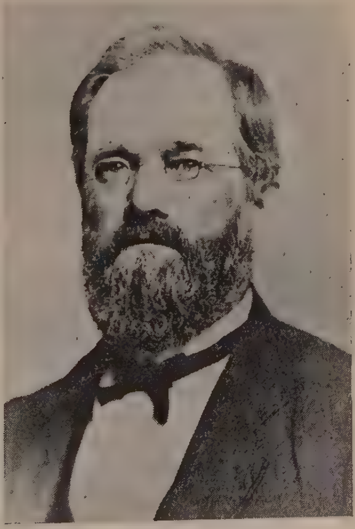
William P. Parrott
1810–1868



Samuel Nott
1815–1899



James Laurie
1811–1875



T. Willis Pratt
1812–1875

FIG. 6

At this time he was nearly seventy years old, about thirty years the senior of most of his colleagues in the Society, and it is natural that he should prefer to become a "humble" member and let the younger and more active engineers carry on its affairs. After *Baldwin's* death, *Samuel Nott*, secretary of the Society, in a letter to Mrs. Baldwin, voiced the esteem in which he had been held by his younger associates in the Society and in the civil engineering profession:

> My call on you a few days ago brought up my always grateful recollections of the kindness, goodness and wisdom which were conspicuous traits in the character of my greatly valued friend, the late *Mr. James F. Baldwin*, whose friendship I enjoyed for more than twenty-five years. It was to me a constant source of encouragement, for which I am devoutly thankful. I have never known a friend who united dignity with simplicity of character in a more happy combination. It was this which most impressed me at the beginning of my acquaintance with him in 1833. The traits of his character noted, made him through life the kind judicious friend of all young men who were trying to fit themselves for usefulness in the profession of Civil Engineering, in which his skill and experience admirably fitted him to be a friend and counsellor, and as such his memory will live in many hearts that have been encouraged by his kindness and benefited by his advice.

References: Nat. Cyclo. of Am. Biog., vol. X, p. 303; New Eng. Hist. and Gen. Soc., vol. XVI, p. 368, and vol. XIX, p. 97; *Jour.* Assoc. of Eng. Soc., vol. V, p. 11 (under Loammi Baldwin); Appleton's Biography, p. 149 (under Loammi Baldwin).

JOSEPH BENNETT

(Born 1814; died April 28, 1875)

Joseph Bennett was born in Massachusetts; no information has been found as to his parents or his early education. He was on the staff of the Boston & Lowell R.R., which was built between 1832 and 1835 with *James F. Baldwin* as chief engineer. He was probably on the construction of the Stonington R.R. in 1838 under Major George W. Whistler (father of the noted artist) at the time of his marriage to Harriet M. Denison at Stonington, Conn. Little is known of his work during the next few years. In 1850 his name appeared as a civil engineer for the only time in the Boston Directory; in 1852 he was engaged in surveys in Brighton for "house lots upon part of the Winthrop Estate."

Later he was employed on the Brooklyn Water Works under James P. Kirkwood, chief engineer. In 1857 he made surveys of Squam and New Found Lakes in New Hampshire in connection with studies for increased water power for *James B. Francis*, engineer for the Proprietors of Locks and Canals on the Merrimack River at Lowell. In letters to *Francis*, he expressed a desire to enter private practice in New England, but it does not appear that he carried out this plan. Although no definite information is available, it is believed that he lived in New York until his death in 1875.

Bennett was one of the most active members of the Society, serving for four years as a director and becoming its first librarian in 1852. He took great interest in the collection of books and models to form a library. In 1850, he was "appointed a Committee to examine the papers of the Society and report . . . as to printing them." He prepared a thorough report on each of the papers, ending with the recommendation that although many of the papers were worthy of publication he believed the cost to be greater than the Society should undertake, but that the papers should be copied in a bound volume to be available in the library. He did, however, recommend the publication of a treatise by *Simeon Borden* on "A System of Useful Formulæ, Adapted to the Practical Operations of Locating and Constructing Railroads." These recommendations were adopted.

His principal achievements were along literary lines. In 1852, he published a translation of D'Aubuisson's "Hydraulics," which he had adapted to British units of measure. This book carried a dedicatory preface to the Boston Society of Civil Engineers. Later he published a translation of Morin's "Mechanics," reduced to British units; *James B. Francis* had given him a copy of the original book, speaking of it in the highest terms. Other articles by *Bennett* appeared in the Journal of the Franklin Institute, most of them being on hydraulic and allied subjects and descriptive of European projects.

It is unfortunate that more information is not available as to his life and work. From his letters to *Francis*, it is evident that his real interests were in literary pursuits along scientific lines rather than in the construction aspects of civil engineering. His talents were such that had he lived a few decades later, he would no doubt have obtained considerable prominence in scientific writing. To him should be given much of the credit for the Society's early establishment of a library of scientific books and professional periodicals.

JOHN HARRISON BLAKE

(Born December 5, 1808; died July 5, 1899)

John Harrison Blake was the son of Thomas Blake of Boston; his ancestors lived in the Blake House, now maintained as a museum by the Dorchester Historical Society. His early education was received at the Boston English High School. From about 1830 to 1837 he and his brother-in-law, Otis Everett, Jr., were in partnership as chemists. He later took charge of copper mines in Cuba, and also explored the Isle Royale region at Lake Superior.

In 1847 he was manager of the Boston Gas Light Company. From 1848 to 1864 he was in partnership with *Franklin Darracott*, consulting chemists and civil engineers, their principal work being gas engineering, which was developing rapidly at this time. They built many gas plants in Massachusetts and served as consultants for plants in other parts of the country. At one time *Blake* was president of five gas companies. He wrote "Observations on Illuminating Gas," a history of the development of that industry. Later *Blake* became interested in the new field of street railways (horse-drawn), and was president of the Metropolitan and of the Middlesex Railroad Companies. During his life he filled many important business and administrative positions, and his interests were extended over a wide field. He was a Fellow of the American Academy of Arts and Sciences.

John H. Blake served on the committee which drafted the Constitution of the Society, and he was elected secretary at its founding on July 3, 1848. He gave a paper on the "Use of Lead Pipes for Carrying Water for Culinary Purposes," and at another time presented a model for a water meter. On June 20, 1877, he was elected an honorary member of the Society.

From an early career in the fields of chemistry and mining he became identified with public utilities, first in the rapidly growing gas industry, and later in the development of street railway transportation. In his office practice he was liberal in giving his associates the benefit of his knowledge and ideas, and regarded this as a contribution which he owed to the advancement of science. His dominant characteristics were his simple faith, his courage, his kindliness, his love of truth, and his earnest desire to do his share in the work of the world.

References: Jour. Assoc. of Eng. Soc., vol. XXV, p. 302; Am. Acad. of Arts and Sciences, vol. XXXVI, p. 565.

SIMEON BORDEN

(Born June 29, 1798; died October 28, 1856)

Simeon Borden was born in Fall River, Mass., and obtained a rudimentary education at the district school. He studied mathematics, geometry and the sciences through his own efforts. His first work was in the practice of surveying, and for this he devised a compass which gave more accurate results than those previously used. In 1830 he constructed a measuring rod for the State of Massachusetts to be used for establishing a base line. Probably *Borden* is best known for his successful carrying out of the survey of Massachusetts. Although handicapped by limited means and relatively crude instruments, the results were excellent and stand as a tribute to his ability and resourcefulness. In 1930, the legislature established the name of *Borden* "for a certain unnamed eminence in the Savoy State Forest . . . to perpetuate the memory of the distinguished engineer, *Simeon Borden*, who conducted such (triangulation) surveys and brought the resulting map to completion." *

Later he was designated to run the boundary of Massachusetts and Rhode Island in accordance with a decision of the United States Supreme Court. He also made surveys for the location of the Cape Cod R.R. and other lines in New England. In 1851, he accomplished a difficult feat in suspending a telegraph wire across the Hudson River, a distance of over a mile, upon masts 220 feet high. In addition to his prowess in surveying, he often served as an expert witness on cases relating to mechanical inventions.

Simeon Borden was vice-president of the Society from 1850 to 1852, and held the office of president at the time of his death in 1856. He presented an elaborate paper before the Society on "A System of Useful Formulæ Adapted to the Practical Operation of Locating and Constructing Railroads," which was later published in book form. He took an active part in the proceedings of the Society and served on various committees dealing with boiler explosions, mechanical devices and surveying instruments. In 1889, the Society was presented a portrait of *Simeon Borden*, its third president. This was the individual gift of the president, Desmond FitzGerald, and its value was greatly enhanced by the fact that it was the work of his own hand.

Membership was held by *Borden* in other learned and scientific societies, including the American Academy of Arts and Sciences and the American Philosophical Society. He received an A.M. degree from Harvard in 1851. Throughout his life his interests were varied, and from the nature of the committees on which he served it is evident that his judgment and ability were held in high regard.

References: Jour. Assoc. of Eng. Soc., vol. VIII, p. 218; Dict. of Am. Biog., vol. II, p. 459; Appleton's Biography, p. 321.

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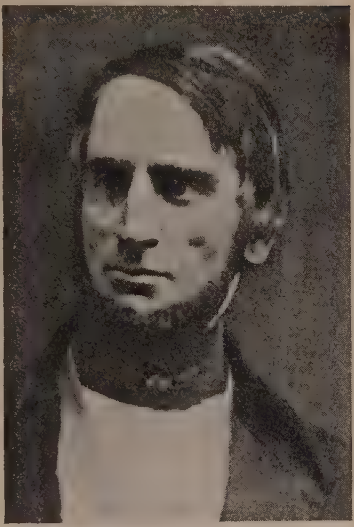
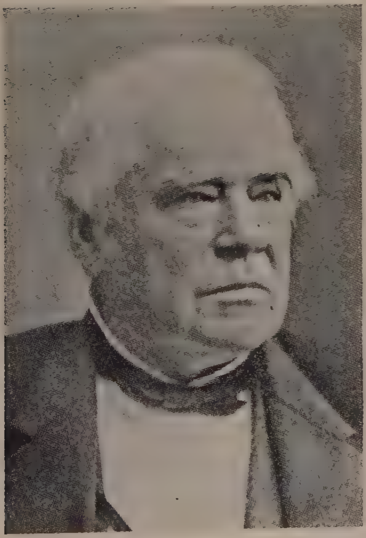
* *Borden* Mountain is 2,565 feet in elevation, located in the town of Savoy, in latitude 42° 36′ 5″ and in longitude 73° 1′ 42″. At the same time, the legislature named Walling Mountain, in the October "Mountain State Forest," in honor of Henry F. Walling, who subsequently extended the survey.

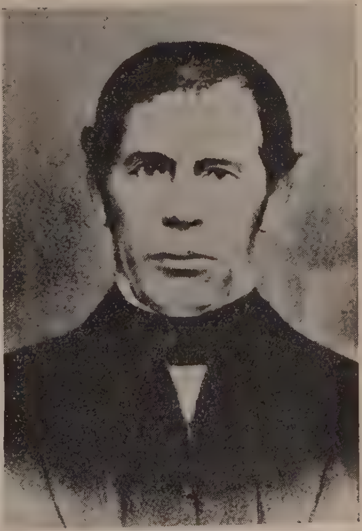
Ellis S. Chesbrough
1813–1886



William S. Whitwell
1809–1899



James B. Francis
1815–1892



Uriah A. Boyden
1804–1879

FIG. 7

URIAH ATHERTON BOYDEN

(Born February 17, 1804; died October 17, 1879)

URIAH ATHERTON BOYDEN was born in Foxborough, Mass., the son of Seth Boyden. He obtained an elementary education at a local school. After a few years in Newark, N. J., with his brother, who was a manufacturer and inventor, he took part in an early survey for a railroad from Boston to Providence. Later he entered the office of Loammi Baldwin, where so many of the civil engineers of this period were trained. From 1836 to 1838 he supervised the construction of the Nashua & Lowell R.R.

About 1840 he opened an office in Boston in Joy's Building, where the Boston Society of Civil Engineers later established its headquarters. *Boyden* at this time entered the field of hydraulics, particularly in the design and improvement of water wheels and turbines. In 1844, he designed a wheel for the Appleton Company at Lowell, along the lines of the Fourneyron turbine, but with mechanical and hydraulic improvements. His first wheel developed an efficiency of 78 per cent,* and before many years this type of turbine was much used throughout New England. He devised the well-known *Boyden* diffuser, and invented the hook-gauge. Many of the refinements in hydraulic design made by him were used by the Proprietors of Locks and Canals in Lowell, and their library contains a wealth of material on turbine development in the early period, including models and original drawings of *Boyden's* devices.

He accumulated a considerable fortune from the sale of his patents on water wheels, and was able to devote the later years of his life to the study of pure science. He left about $230,000 to Harvard College which was used for founding the Harvard Observatory in Peru.

Uriah Atherton Boyden joined the Society at its organization, and attended the meetings fairly regularly for the first two years. In 1850 a by-law was passed providing for a fine of 50 cents for any member not attending a meeting unless he was more than thirty miles away, and for a fine of 25 cents for any member arriving after the meeting was called to order. *Boyden* objected to this action and resigned.

He received the degree of A.M. from Harvard College in 1853. He gave $1,800 to the Boston Athenæum "to supply deficiencies in the series of scientific transactions and memoirs." *Uriah A. Boyden* will always be associated with those other early New England hydraulicians who played such an important part in the improvement and development of that field.

References: Dict. of Am. Biog., vol. II, p. 529; Nat. Cyclo. of Am. Biog., vol. XI, p. 88; Foxborough Centennial, 1878; Appleton's Biography, p. 341; *Trans.* Am. Soc. of Civil Eng., vol. LXXXV, p. 1237 (this article by A. T. Safford and E. P. Hamilton, on the "American Mixed-Flow Turbine and Its Setting," contains much information on the water wheels and appurtenances developed by *Boyden*); *J. B. Francis*' "Lowell Hydraulic Experiments" also furnishes data on this subject.

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* *J. B. Francis*, "Lowell Hydraulic Experiments."

ELLIS SYLVESTER CHESBROUGH

(Born July 6, 1813; died August 18, 1886)

Ellis Sylvester Chesbrough was born in Maryland, the son of Isaac Chesbrough. He had almost no formal schooling and at fifteen became a rodman on the Baltimore & Ohio R.R. For the next eighteen years he was engaged in railroad surveys and construction exclusively; in addition to work in the Middle West he was connected with the Boston & Providence, Lowell & Nashua, and Cheshire Railroads in New England. In 1846 the course of his professional life was changed by his acceptance of the position of chief engineer for the western division of the new Boston water supply project.*

On January 4, 1850, the organization of the First Cochituate Water Board took place, with *Chesbrough* as water commissioner and *Whitwell* as engineer. On November 18, 1850, a new form of organization was adopted which provided for the appointment of a city engineer of Boston among whose duties would be taking charge of all the properties of the Cochituate water supply. *Chesbrough* was chosen to fill this position. In 1933 the city designated the name of Chesbrough Road to one of its streets in lasting memory of its first city engineer.

In 1855 he resigned to become chief engineer for the Chicago Sewerage Board. Plans for this project were made and construction started in 1856. *Chesbrough* visited the principal cities in Europe and presented an exhaustive report which was the most thorough study which had ever been made and had a far-reaching effect on the development of sewerage practice throughout the country. In 1861, a Board of Public Works was formed to take charge of all municipal works, including water and sewers, and *Chesbrough* was chosen as chief engineer. He served in this capacity (or under the title of city engineer) until 1879, and during this period carried out many important municipal projects. While city engineer and subsequent thereto he acted as consultant on sewerage and water works for cities in all parts of this country and Canada. In 1876 he served on the Sewerage Commission of Boston, which recommended an improved sewerage system. After giving up his position in Chicago, he became permanent consulting engineer for the Croton water supply for the city of New York, a position he held until his death.

Ellis Sylvester Chesbrough acted as chairman of the informal meetings which led to the formal organization of the Society on July 3, 1848, at which time he became a director, serving for four years. He was vice-president from December 6, 1852, to March 1, 1853, and treasurer from that date until he left Boston in 1855. To *Chesbrough* should be given much of the credit for the inception of the idea of forming a society of civil engineers and for the successful carrying out of the plan. His influence in the Society is clearly shown by the fact that so many of his associates on the Boston water supply became active members at the outset. He was present at every meeting but one until he left Boston in 1855. He gave a paper on "Contracts" which was one of the most valuable contributions to the proceedings. On June 20, 1877, he was elected an honorary member of the Society.

His professional career was a remarkable one. Despite the lack of almost any formal education he rose to a position of eminence in the field of civil engineering. For a quarter of a century he was the recognized head of sanitary engineering in this country. He possessed farsightedness and a broad common sense. His diplomacy in meeting and overcoming opposition was a trait which stood him in good stead in carrying through his plans. His kindness and consideration of all other members of the profession, particularly the younger men seeking employment or information, was notable.

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* See p. 165 for description of this project.

His contribution to the development of the three oldest engineering societies in the United States was unique. In the Boston Society of Civil Engineers he was chairman of the group which organized the Society, he held office as director, treasurer and vice-president, and later became an honorary member; in the American Society of Civil Engineers he served as president and became an honorary member; and in the Western Society of Engineers he held the office of president for many years.

References: Jour., Assoc. of Eng. Soc., vol. VI, pp. 1 and 129; *Proc.* Amer. Soc. of Civil Eng., vol. XV, p. 160; *Jour.*, Wes. Soc. of Eng., vol. XXIV, pp. 470 and 500; Nat. Cyclo. of Am. Biog., vol. IX, p. 35.

JOHN CHILDE

(Born August 30, 1802; died February 2, 1858)

Captain John Childe was born in West Boylston, Mass., the son of Zachariah Childe, a soldier of the Revolution. He graduated from West Point in 1827. After eight years in the army, he resigned to apply his talents to civil engineering, a pioneer profession which was then attracting many of those who had received their training at West Point, which was one of the few places where even the rudiments of civil engineering were taught.

From 1836 to 1844 he was on the location and construction of the Western R.R. (of Massachusetts), with General William G. McNeill, Major George W. Whistler, and Captain W. H. Swift, — all of whom were graduates of West Point. *Childe* was in charge of the surveys across the Berkshire Mountains where the location was difficult, requiring much skill to keep the line within reasonable limits of grade and curvature. In 1844 and 1845 he was chief engineer of the Troy & Albany R.R., and shortly after that consulting engineer of the Connecticut River R.R.

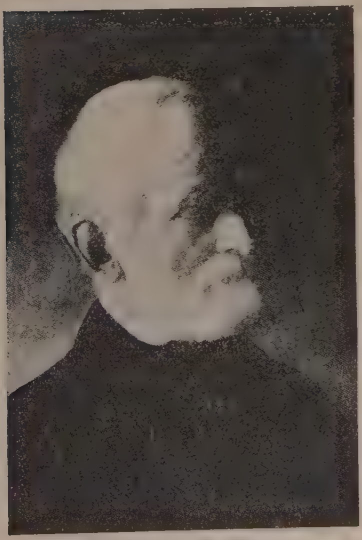
During the next two or three years he was engaged in surveys or as consulting engineer for many railroads, including the Cincinnati & Hamilton R.R., Buffalo & Niagara Falls R.R., Ohio Central R.R., Baltimore & Ohio R.R. *Childe* was chief engineer for the Cleveland, Columbus & Cincinnati R.R. from 1848 to 1851, locating and supervising the construction of 136 miles of road. He devoted only part of his time to his work, however, as he served also as chief engineer of the Mobile & Ohio R.R., 500 miles long, the longest road up to that time under one management. After four years of the most arduous work, *Captain Childe* was made general superintendent of transportation in addition to his title of chief engineer and general agent.

In 1850 he was associated with General William G. McNeill and C. S. Growski, a civil engineer of Canada, in reporting upon plans for the improvement of navigation on the St. Lawrence River. Later he was employed by the Board of Harbor Commissioners of Montreal to prepare a plan for the development of an extensive harbor for that city.

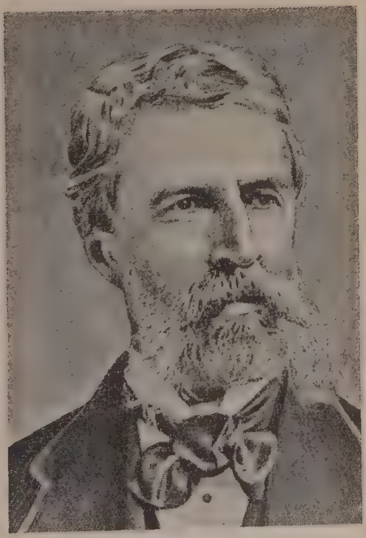
Captain John Childe joined the Society on July 3, 1848, at which time he was located at Springfield, Mass., as consulting engineer for the Connecticut River R.R., but his far-flung activities kept him continually traveling from one project to another.

Samuel M. Felton
1809–1889

George A. Parker
1822–1887



Waldo Higginson
1814–1894



Isaac Hinckley
1815–1888

FIG. 8

Although contributing to the Society's support he was unable to take active part in the meetings. In the short span of his civil engineering career (1835 to 1858), he accomplished an almost unbelievable amount of important work. The foregoing account of his professional engagements is far from complete; only the major ones have been touched upon. In addition to his civil engineering prowess he is said to have been the inventor of many mechanical improvements, including hoisting machinery for transferring freight from cars to boats, the variable cut-off for locomotives, and the extended firebox. His enthusiasm for his work, his incessant industry, and his power of executing the most elaborate work were the dominant characteristics which made possible these accomplishments.

References: Stuart's "Civil and Military Engineers of America," p. 177; Nat. Cyclo. of Am. Biog., vol. XVI, p. 359.

MARSHALL CONANT

(Born January 5, 1801; died February 10, 1873)

Marshall Conant was born in Woodstock, Vt. He planned to learn the carpenter's trade, but due to ill health, which confined him to his bed for a long time, he studied astronomy and the natural sciences. After teaching school for some time he attended Dartmouth College, graduating in 1839. He prepared "The Complete New England Almanac for 1831" and the Ephemeris for 1836, and the next year edited the "Astronomical and Philosophical Annual." His first civil engineering work was apparently on the Cochituate Aqueduct, where he served as an assistant engineer, under *T. E. Sickels*, who was resident engineer at the western end of the project. Upon the organization of the First Cochituate Water Board in January, 1850, *Conant* was appointed as surveyor under the commissioner, *E. S. Chesbrough.*

In 1853 he became principal of the Bridgewater Normal School, where his work was outstanding. During this period the library and equipment was increased and the attendance became greater than the building could properly accommodate. One of the graduates said of him, "Many a one owes to him an awakening and an inspiration which changed the whole current of his thought and ennobled his whole life." Another said, "In my list of helpers and inspirers he stands among the highest." Owing to illness he was forced to resign at Bridgewater in 1860. After regaining his health he went to Washington, where he served with the United States Bureau of Internal Revenue for about ten years.

Marshall Conant joined the Society shortly after its founding, and took an active part in its proceedings. One of the papers he presented, "An Investigation in Regard to the Concavity of Surface of Incompressible Fluid Contained in Vessels in Motion on their Vertical Axis," was a distinct contribution to the science of that time. He designed a "Solar Index," an instrument "contrived for the purpose of affording the engineer and surveyor a ready and convenient method of ascertaining the direction of the meridian." A complete description of the instrument was sent by him to the American Academy of Arts and Sciences. Later this paper was presented before the Society, together with a demonstration of the device. His aptitude for scientific pursuits and his keen interest in educational matters were the outstanding features of his career.

References: "History and Genealogy of Conant Family in England and America;" "Bridgewater Normal School," published in 1892.

FRANKLIN DARRACOTT

(Born September 24, 1820; died January 24, 1895)

Franklin Darracott was born in Boston, the son of George Darracott who at one time was president of the Boston Gas Company. He attended the Boston English High School. His first important work was with the Boston & Worcester R.R., where under his direction parts of the line were rebuilt with improved alignment. Later he made surveys for a railroad between New London and New Haven. Soon after this he entered the field of gas lighting, and was for some time associated with his father at plants at Boston and Lowell. From 1848 to 1864 he was a partner of *John H. Blake*, consulting chemical and civil engineers specializing in the construction of gas works. This firm designed and built many gas works throughout New England, as well as serving as consultants for plants in other parts of the country. Little information is available as to *Darracott's* professional work from 1865 to 1885. From 1874 to 1877 he served as water commissioner for the town of Brookline. About 1885 he went to New York City where he was in business for the next ten years as vice-president of the Nason Manufacturing Company, a firm making heating and plumbing equipment and supplies.

Franklin Darracott attended the informal meetings which led to the founding of the Society on July 3, 1848. Although not active in the presentation of papers, he served on several committees. In 1852 he was on the committee which arranged with the New England Association of Railroad Superintendents, an organization formed in 1848 practically simultaneously with the Boston Society of Civil Engineers and with many members in common, for the use of adjoining rooms with a common library. Several years later (1874), at the time of the reorganization of the Society, *Darracott* was empowered by warrant to call a meeting of the members of the incorporated Society. He presided at this meeting on April 27, 1874, at which *James B. Francis* was elected president and *Samuel Nott*, secretary. On June 8, 1874, *Darracott* was elected treasurer, a position he held for a short time, until new officers representing the younger and active group which had joined the Society were elected to carry on its activities. On June 20, 1877, *Franklin Darracott* was elected an honorary member of the Society.

Those who knew him describe him "as having been a gentleman of the old school and very much beloved by his employees." His courteous demeanor was marked both in his business and family life. In the records of the Marland family * it is stated "that the Darracott home, whether in Andover, Boston, Roxbury, Brookline or New York City, was a rendezvous of all nephews and nieces of both Mr. and Mrs. Darracott on Sundays, *provided they had first attended divine service.*"

WILLIAM LEE DEARBORN

(Born June 12, 1812; died March 15, 1875)

William Lee Dearborn, born in Salem, Mass., was the son of Alexander Scammel Dearborn, a man distinguished for his public services and literary labors, and the grandson of General Henry Dearborn who served as an officer in the revolutionary army and the War of 1812. He was educated in a classical school at Brookline. At an early age he decided to follow civil engineering, his first professional work being on the Boston & Providence R.R. under his relative, General William R. Lee. Subsequently he was employed on the fortifications in Portland (Me.) Harbor, and then became chief engineer for a survey for a railroad from Portland to Lake Champlain. In 1840 he was an assistant with the United States Topographical Engineers on the location of the northeastern boundary of the United States. About 1845, he was engaged on surveys for the Worcester & Nashua R.R.

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* *Franklin Darracott* married Julia Maria Marland of Andover, daughter of the owner of the Marland Mills.

Dearborn's most important engineering work in Massachusetts was probably as chief engineer of the Grand Junction Railroad which was chartered in 1847, with a capital of $1,200,000, to build a line to connect the Eastern, Boston & Maine, Fitchburg and Boston & Lowell Railroads with the terminal of the Grand Junction R.R. upon tidewater at East Boston. The property of the company at East Boston consisted of thirty acres, mostly made land with eight piers, four of them 350 feet long and 75 feet wide, the others being somewhat shorter. The railroad itself was 6.6 miles long and built "in a very superior manner." The importance of this railroad and terminal company in providing ocean shipping facilities for the four railroad lines entering Boston from the north was clearly recognized at the time of the Boston Railroad Jubilee.*

Following the completion of this project, *Dearborn* was engaged on the construction of breakwaters and lighthouses in Boston Harbor and in Maine. From 1855 to 1860 he maintained an office as civil engineer in Boston. In 1868 he moved to New York where he served as resident engineer on the enlargement of the Croton Aqueduct across High Bridge, and on reservoir and pumping plants for the supply of the upper part of Manhattan. In 1872 he was appointed principal assistant engineer for the Fourth Avenue Improvement in New York City, which included a depressed road from 42d Street to Harlem River. He held this position at the time of his death in 1875. For the latter part of his life he was a great sufferer from an incurable disease, which, while it checked his physical force, never impaired his mental activity.

William Lee Dearborn joined the Society on March 6, 1849; he served as a director from 1851 to 1852. He was a member of the committee which was appointed to report to the Society from time to time on matters of interest found in the legislative proceedings of Massachusetts and other States. After moving to New York in 1868, he became a member of the American Society of Civil Engineers.

References: Proc., Amer. Soc. of Civil Eng., vol. I, p. 330; Nat. Cyclo. of Am. Biog., vol. IX, p. 41.

GEORGE MINOT DEXTER

(Born November 15, 1802; died November 26, 1872)

George Minot Dexter was born in Boston, the son of Dr. Aaron Dexter, who was a physician in Boston and a Professor of Medicine at Harvard. He attended Harvard College with the class of 1821 but did not complete the course owing to poor health. He lived in Paris for several years on account of his health, and at that time was interested in both engineering and architecture. He returned to Boston about 1831 and entered as a pupil in the office of Loammi Baldwin. In 1834 he was an assistant engineer on the construction of the Boston & Lowell R.R., under *James F. Baldwin.*

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* For an account of the Railroad Jubilee, see p. 168.

Upon its completion, *Dexter* was appointed agent, a title then used in the manufacturing companies which was equivalent to superintendent or general manager. The notice announcing the first train to run between Boston and Lowell was issued by him.

He later left this position to follow the field of architecture. His first work was the planning and building of houses upon the Gardner Green estate, then graded and laid out as Pemberton Square in Boston. For the next two decades he was engaged in architectural pursuits in Boston, although also connected with some New England railroad activities. From 1846 to 1849 he and Edward C. Cabot were associated in the design and construction of the new building on Beacon Street for the Boston Athenæum, which moved its library of 50,000 books to this location in 1849. He was the designer of the Fitchburg R.R. depot, opened in 1848, and which was one of the most pretentious railroad stations of that period. In 1850 the eventful concerts of Jenny Lind were held in the depot of this station. In 1852, he became treasurer of the Vermont Central R.R. which had been through much financial trouble. Later he served as president and director of this railroad, and for a time as trustee.

George Minot Dexter attended the informal meetings which led to the founding of the Society on July 3, 1848. He was a regular attendant at the meetings, and although he did not present any papers, he was keenly interested in the affairs of the Society, and served on many of its committees. He was vice-president from 1848 to 1850, at which time he became president, a position he held until 1852. *Dexter* joined the American Society of Civil Engineers in December, 1852.

For many years he was closely connected with the affairs of Trinity Church, being senior warden at the time of his death. After the burning of the church on Summer Street in the "Boston" fire he worked very hard superintending the removal of the bodies from the vault beneath the church to the Mount Auburn Cemetery. As a result of this exposure, he caught a cold which resulted in his death. His private character was exemplary; no one ever came in contact with him without feeling the better for it.

Reference: Jour., Assoc. of Eng. Soc., vol. VIII, p. 218.

SERENO DWIGHT EATON

(Born January 28, 1823; died August 10, 1899)

Sereno Dwight Eaton was born at Framingham, Mass., on the Eaton Farm (owned by the Eaton family since early in the eighteenth century). He is believed to have attended Worcester (Mass.) Academy for a time. Between 1848 and 1850 he was a civil engineer for the Old Colony R.R., probably on the construction of its branch lines near Boston. In addition to railroad work he made surveys for mapping purposes, and there are in existence several plans made by him in 1850 of parts of Dorchester and Brighton, showing house lots.

In 1850, he made a survey for a railroad from Springfield, Ill., to Decatur, Ill. (probably the Great Western (Ill.) Railway, later part of the Wabash system). His diaries for both of these trips give an interesting account of the difficulties of travel and of his opinion of Chicago, then a city of 30,000 inhabitants. About 1857 he went west again, this time to remain permanently, and for the next forty years was actively engaged in engineering and contracting on railroad work. In 1858 he was engineer and superintendent of the Keokuk, Fort Des Moines & Minnesota R.R. He located, built and operated the railroad from Keokuk to Eddysville, Iowa (96 miles) until the outbreak of the Civil War. At the beginning of the war he went to St. Louis and was in charge of the transportation of troops by rail for that territory, and at one time was responsible for the operation of the railroad from St. Louis to Louisville, Ky., then known as the Ohio & Mississippi R.R.

After the war *Eaton* went to Hannibal, Mo., and surveyed and built the Hannibal & Naples R.R., now part of the Wabash system, and the line from Hannibal to Moverly, Mo., now part of the Missouri, Kansas & Texas system. *Josiah Hunt* was a director for both of these railroads. In 1878 he entered the service of the Chicago, Burlington & Quincy R.R. at Burlington, Iowa, and made surveys for proposed lines in Iowa. At various times in the early seventies he had worked as a contractor on heavy steam shovel work, and after about 1880 he was chiefly engaged in railroad contracting. For a short time he served as city engineer of Burlington, Iowa. At the time of his death he was engaged in steam shovel work on the Chicago Great Western R.R. Most of the information about his work in the West has been obtained from his son, W. D. Eaton, formerly Iowa district attorney for the Chicago, Burlington & Quincy R.R.

Sereno Dwight Eaton joined the Society on October 2, 1848. For the next two years, until he moved to the West, he took an active part in the Society and was a regular attendant at its meetings.

ROBERT HENRY EDDY

(Born September 27, 1812; died May 13, 1887)

Robert Henry Eddy was born in Boston and received his early education at the Boston English High School, after which he studied architecture for a time under Asher Benjamin. Later he decided to become a civil engineer and entered the office of Loammi Baldwin, where he received a theoretical as well as a practical training. At the age of twenty-one he became civil engineer for the East Boston Company, and for a number of years he was actively engaged in the development of East Boston, laying out lots, building roads and wharves, and making other improvements.

For at least forty years he maintained an office in Boston as a civil engineer. In 1836, he was employed by a committee, chosen by Mayor Samuel T. Armstrong, to report upon the cost of the introduction of water from Spot and Mystic Ponds into the city of Boston. He recommended the development of sources of supply near Boston rather than the adoption of Long Pond in Framingham.

In 1838 he addressed a communication to Samuel A. Eliot, Mayor of Boston, again urging the development of Spot and Mystic Ponds as a source of supply. For the next eight years the controversy between the advocates of Long Pond (Lake Cochituate), Framingham, and the near-by sources continued, until finally in 1846 the Long Pond scheme was adopted and construction started. *Eddy* visited Europe in 1838–39 inspecting the public works which had been constructed. After about 1847, he gave up his engineering practice to a large extent and became a solicitor of patents, being perhaps the first to establish that profession in this country. For the next twenty-five years until his retirement he was an extensive practitioner in patent matters. He retired from business in 1873 and devoted much time to scientific, historical and genealogical affairs.

Robert Henry Eddy joined the Society on December 3, 1849. He was a regular attendant at the meetings for several years, resigning in 1853. His interest in civil engineering apparently lessened as he became more active in patent law. In 1850, he presented before the Society a paper on "An Improvement in Lithography, particularly Applicable to the Production of Copies of Topographical, Mechanical and Line Drawing in General." This paper told of the recent introduction from England of a transparent tracing cloth termed "Dowse's Vellum Cloth," and *Eddy* described in detail how effectively this material could be used in making drawings for reproduction. He also demonstrated the Electric Thermic Telegraph at one of the meetings.

His interests were varied. He was a Fellow of the Royal Historical Society of Great Britain and a member of the New England Historical and Genealogical Society. He made a bequest to the latter organization, some of which has been used in preparing vital records of Massachusetts towns, and a room has been named in his memory at its headquarters.

References: "The Eddy Family in America," 1930; Memoirs of Members of the New England Historical and Genealogical Society.

SAMUEL MORSE FELTON

(Born July 17, 1809; died January 24, 1889)

Samuel Morse Felton was born at West Newbury, Mass., the son of Cornelius C. Felton. After working for a few years in Boston he entered a county high school in New York State, where his brother was principal. He graduated with high honors from Harvard College in 1834 and three years later received the master's degree. For the next two years he conducted a private school in Charlestown, Mass., planning at that time to study law. He soon decided to enter the civil engineering profession and became a student of Loammi Baldwin, at the same time serving there as a teacher of mathematics. Among those studying civil engineering under Baldwin at about that time were *U. A. Boyden, G. M. Dexter, R. H. Eddy, Waldo Higginson, S. F. Johnson, H. S. McKean, G. A. Parker.* After Loammi Baldwin's death in 1838, *Felton* carried on the office on his account, and several of the students, including *Johnson* and *Parker*, remained with him.

In 1841, *Felton* made surveys for the Fresh Pond R.R., the forerunner of the Fitchburg R.R. The next year he made surveys for the Fitchburg R.R., and when construction started he became chief engineer for the eastern section of this road. In 1845 he became superintendent, a position which he held until 1851. During this period he also made surveys for the Cheshire R.R., Rutland & Burlington R.R., was chief engineer of the Vermont Central R.R., and consulting engineer for the Sullivan and for the Ogdensburg Railroads.

In 1851 he was made president of the Philadelphia, Wilmington & Baltimore R.R. (now an integral part of the Pennsylvania R.R. System). Although occupying an important location between rapidly developing cities, this road had never met with financial success. For the next ten years he was busily engaged in building up the property and improving its method of operation. As a result this road became profitable and formed an important link in the nation's growing transportation system. But with the outbreak of the Civil War the difficulties of operating this railroad became tremendous, due to its important location as a route from the North to Baltimore, a city in which the Confederate feeling ran high. It was through *Felton's* plans that President Lincoln made his trip safely through Baltimore at a time when rumors of an attempted assassination were rife. As a result of his strenuous exertions during this war period, *Felton's* health, late in 1864, forced him to retire. He was succeeded temporarily by *George A. Parker* as acting president, and soon after by *Isaac Hinckley*, who filled the position with great credit for many years.

After a year of rest his health improved and he became president of the Pennsylvania Steel Company and held that position for nearly twenty-five years. During this period he retained his railroad interests serving as director of many railroads. From 1862 to 1865 he was a commissioner of the Hoosac Tunnel. He was also president of the Delaware R.R. almost to the time of his death.

Samuel Morse Felton joined the Society on October 2, 1848. He served as a director from 1849 to 1851, and took an active interest in the Society until he left Boston. On November 15, 1876, he was elected an honorary member of the Society. He was also active in the New England Association of Railroad Superintendents. Here he was particularly engaged with operating problems, and served on many committees dealing with these matters. He was also a member of the American Society of Civil Engineers. *Felton's* life was marked by success as a teacher, an engineer, a railroad president, and as an industrialist. He enjoyed the respect, confidence and affections of all who knew him. It is interesting to note that his son, Samuel M. Felton, Jr., enjoyed great prominence in the railroad field for many years as president of the Chicago Great Western R.R., and served with distinction in charge of the United States Military Railroads during the World War.

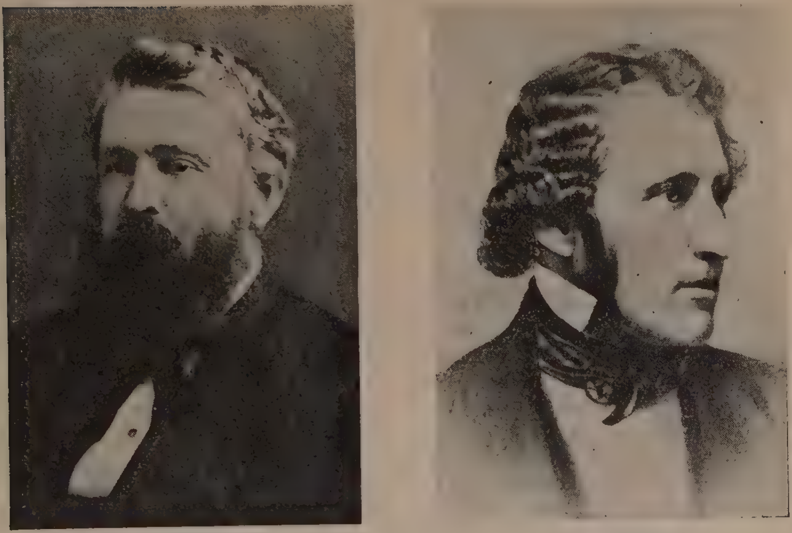
References: Jour., Assoc. of Eng. Soc., vol. XI, p. 199; *Proc.*, Amer. Soc. of Civil Eng., vol. XIX, p. 92; Dict. of Amer. Biog., vol. VI, p. 318; Memorials of Class of 1834, Harvard College.

JAMES BICHENO FRANCIS

(Born May 18, 1815; died September 18, 1892)

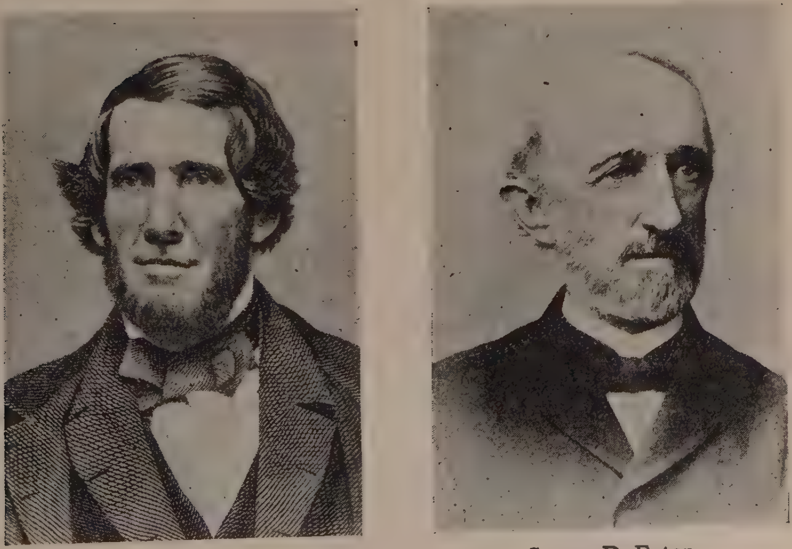
James Bicheno Francis was born in England, and at the age of eighteen came to America, where he found employment on the Stonington (Conn.) R.R. under Major George W. Whistler. Later Whistler was appointed engineer for the Proprietors of Locks and Canals at Lowell. *Francis* went with him as a draftsman, and as one of his first tasks dismembered and measured the detached parts of a locomotive made by Stephenson and brought over from England to serve as a model for engines of the Boston & Lowell R.R. He soon was put in responsible charge of the construction of the Boott Cotton Mills. About 1837 Whistler resigned and *Francis* at the age of twenty-two was appointed to his position. Lacking any formal scientific education he formed the habit of studying mathematics and the sciences and became a master of them. In 1845 he was made agent, a position equivalent to general manager, and for more than forty years he was in charge of the dam, canals and water power, and acted as consulting engineer to the factories associated in this group.

At about this time *Uriah A. Boyden* had planned and built his first water wheel, and soon afterwards *Francis* made tests on many of *Boyden's* hydraulic appliances. In 1855 *Francis* published his "Lowell Hydraulic Experiments," one of the most valuable contributions to hydraulic science. In 1849 the Locks and Canals secured the patent rights for the Howd type of water wheel, and *Francis* built and experimented



Josiah Hunt
1818–1874

Lucian Tilton
1811–1877



John Childe
1802–1858

Sereno D. Eaton
1823–1899

FIG. 9

upon wheels of this general inward flow type, which, with its improvements, became known as the *Francis* type. The two wheels developed by *Boyden* and *Francis* marked a distinct step forward in American wheel practice. The Howd-Francis wheel was the forerunner of all modern reaction wheels, later to be developed into the mixed-flow turbine.* He will also be remembered for the "*Francis*'" formula for the flow of water in open channels. In 1848, *Francis* built an emergency gate near the head of one of the canals in Lowell to be used in case of extreme high water. Many believed this structure unnecessary and dubbed it *Francis*' "Folly." But his foresight was amply justified, because the gate was made use of in 1852, and again in the flood of 1936 it was closed, protecting the canals and a section of the city from inundation and great damage.

Francis' activities, however, were not limited to hydraulic engineering alone, as he made extensive studies of the preservation of timber, visiting England to study the processes in use there. Upon returning, he built a plant for the Kyanizing process. Fire protection of the mill properties received much attention by *Francis*, the companies agreeing on a system of mutual protection against fire loss, and as a result for forty years the fire loss for these mills was said to be scarcely half as great as among the cotton factories of New England as a whole. His contributions to science through his publications showed the breadth of his interests; these included hydraulic experiments, deflection of beams, strength of cast-iron pillars, and many others.†

James Bicheno Francis was a founder member of the Society. He did not attend many of the meetings in its early years, probably due to the arduous duties imposed upon him at Lowell during this period (1848–55). Later, at the time of the Society reorganization, he served as president for a short time. He was elected an honorary member on May 20, 1891.

He joined the American Society of Civil Engineers immediately after its first meeting. In 1880 he served as president and in 1892 became an honorary member. *Francis* was also a valued member of the American Academy of Arts and Sciences, and one of the incorporators of the Massachusetts Institute of Technology in which he took great interest. He also found time to serve as a member of the Massachusetts legislature, on the Lowell City Government and on many boards and commissions. At the present time a special room at the offices of the Locks and Canals in Lowell is devoted to *Francis* in which may be found his voluminous correspondence for over half a century. This has been bound in permanent form by his successors on the Locks and Canals. Arthur T. Safford, Past-President of the Society, is now the engineer for the Locks and Canals. Perusal of this material shows letters from eminent engineers all over the country discussing engineering problems and seeking his advice and suggestions.

New England has been noted for its contributions to hydraulic science and engineering through the experiments and writings of its hydraulicians who were connected with water powers at Lowell, Lawrence and Holyoke. These include such names as *James B. Francis*, Charles S. Storrow, *Uriah A. Boyden*, Hiram F. Mills, Clemens Herschel, John R. Freeman and many others. Much of our present hydraulic knowledge has been learned through such men as these, and *James B. Francis* will always be honored as one of those pioneers, who, by untiring energy and great ability, contributed so vastly to the advancement of the profession of civil engineering in the field of hydraulics.

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* "The American Mixed-Flow Turbine and Its Setting," by Safford and Hamilton *Transactions*, American Society of Civil Engineers, vol. LXXXV, p. 1237.

† His writings are shown in a list appended to his memoir published in the *Proceedings*, American Society of Civil Engineers, vol. XIX, p. 74.

References: Jour., Assoc. of Eng. Soc., vol. XIII, p. 1; *Proc.*, Amer. Soc. of Civil Eng., vol. XIX, p. 74; Dict. of Amer. Biog., vol. VI, p. 578; Nat. Cyclo. of Am. Biog., vol. IX, p. 46.

CHARLES HAYNES HASWELL*

(Born May 22, 1809; died May 12, 1907)

Charles Haynes Haswell was born in New York City, the son of Charles Haswell, a member of the British diplomatic service. After education in the schools of New York he entered the employ of James P. Allaire, owner of an important steam engine works, where he obtained a practical and thorough knowledge of mechanical and marine engineering. In 1843 he was appointed first engineer-in-chief of the United States Navy, a position he held until 1851, when he engaged in private practice in New York as a civil and marine engineer. Although *Haswell* was best known through his activities in steam and marine engineering, his work covered nearly all branches of civil and mechanical engineering. He was the author of a well-known "Engineers and Mechanics Pocket Book," which was a standard of its kind for over sixty years.

He was a member of the City Board of Councilmen from 1855 to 1858, one of the trustees of Brooklyn bridge, and from 1898 to his death consulting engineer to the Board of Public Improvement and the Board of Estimate and Apportionment. He was known and honored by engineers and naval architects in many countries throughout the world. He contributed papers to engineering societies here and abroad.

Charles Haynes Haswell was elected a corresponding member of the Society on June 3, 1850. He was in Washington, D. C., at that time, but shortly thereafter established an office in New York City. He did not attend the meetings of the Society, but fulfilled his duties as the Society's sole corresponding member, the donation book containing a considerable list of books and reports which he presented to the library. On June 16, 1886, he was elected an honorary member of the Society. He held membership in many technical societies here and abroad. He became an honorary member of the American Society of Civil Engineers in 1905.

At the time of his death, *Haswell* was undoubtedly the oldest civil engineer in the world; in ten days he would have entered his ninety-ninth year. His career was a remarkable one both for length of service and breadth of interest. Few engineers have become eminent in so many lines. Despite his great achievements, he rarely spoke of them, being unusually modest, but his works spoke for themselves, and his varied and useful career will always occupy an important niche in the development of the profession of engineering from the broadest standpoint.

References: Trans., Amer. Soc. of Civil Eng., vol. LXI, p. 563; Dict. of Amer. Biog., vol. VIII, p. 391; Nat. Cyclo. of Am. Biog., vol. IX, p. 486.

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* Corresponding Member, Boston Society of Civil Engineers.

WALDO HIGGINSON

(Born May 1, 1814; died May 4, 1894)

Waldo Higginson was born in Boston, the son of Stephen Higginson. He graduated from Harvard College in 1833, and for a year or two studied law. He soon decided to become a civil engineer, and entered the office of Loammi Baldwin. His first professional work was in 1837 on the construction of a state railroad in Georgia. Returning to New England the next year he became assistant engineer of the Eastern R.R. For the next few years he was in private practice principally engaged in railroad surveys and reports. In 1844 he was in charge of a survey for a railroad route from Brattleboro, Vt., following the valley of the West River, thence across the Green Mountains with a view to a continuation to Rutland and Burlington, Vt. This study included a proposed tunnel 5,070 feet long. In 1845 *Higginson* became agent and engineer of the Boston & Lowell R.R., a position which he held until 1853 when he was stricken with paralysis.

In 1856 he had recovered sufficiently to start the New England Railroad Mutual Insurance Company, but after a few years it appeared that this principle was not well adapted to the railroad business, and the company was dissolved. A few years later, however, he organized the Arkwright Mutual Fire Insurance Company, for manufacturing plants, and he was president of this company until 1892. His health did not allow him to do any active work, such as the inspections of risks. His management was progressive and he gave valuable support to the placing of the work of inspections on a scientific basis. His upright character, honesty and reliability stood out so strongly that he was always looked upon as one whose judgment could safely be followed.

Waldo Higginson joined the Society on October 2, 1848, and took an active part in its affairs. He presented to the Society a very complete report on his railroad survey from Brattleboro northward. He was a member of the Society's committee which reported on the explosion of a locomotive boiler on the Western R.R. (now the Boston & Albany R.R.); this was published in full in the Boston daily papers.

His name is also closely identified with the New England Association of Railroad Superintendents of which he was one of the founders and which he served temporarily as secretary until *William P. Parrott* was elected to that position permanently. *Higginson* was one of the most active members of the Association and served on numerous committees, including such matters as by-laws, publication of a railroad gazette, investigation of patents, and rules regarding freight and passengers. After his retirement from railroad work, the Association presented him with a pitcher and salver as a testimonial to the esteem in which he was held by his associates in that organization.

Waldo Higginson joined the American Society of Civil Engineers in 1853. From 1869 to 1873 he served as an overseer of Harvard, from which he had received an A.M. degree in 1856. Despite the failure of his health at the age of thirty-nine, and his impaired physical vigor for the thirty-five years following this illness, *Higginson* accomplished much. His establishment of the Arkwright Mutual Life Insurance Company, and his skilful management of that organization for many years, give ample testimony as to his character and ability.

References: Memorials of the Class of 1833 of Harvard College; New England Hist. and Gen. Register, vol. L, p. 79.

ISAAC HINCKLEY

(Born October 28, 1815; died March 28, 1888)

Isaac Hinckley was born at Hingham, Mass., the son of Isaac Hinckley. He attended Harvard as a member of the class of 1834 but did not complete the course on account of trouble with his eyes; in 1865 Harvard awarded him the degree. His earnest desire was to become a civil engineer, but constant difficulty with his eyes forced him to give up this plan. In 1836 he went to Illinois where for a few years he had a varied career, serving as agent for a land company, a gentleman farmer, postmaster, justice of the peace and surveyor. Returning east he became connected with the Boston & Providence R.R., and in 1848 was superintendent of the Providence & Worcester R.R. Two years later he went to Lowell as superintendent of the Merrimac Manufacturing Company, where he remained for a number of years. He served as director for numerous railroads and other corporations, including the Boston & Lowell R.R., Lowell Gas Light Company, Lowell Institution for Savings, and others. In 1853, in the midst of the financial tangles and litigation of the Vermont Central R.R., he was a member of a committee of stockholders which carried on an investigation of the road's affairs. *Hinckley* returned to railroading in 1865 as president of the Philadelphia, Wilmington & Baltimore R.R. (now part of the Pennsylvania R.R. system). He served in this capacity until his death more than twenty years later.

Isaac Hinckley joined the Society on March 22, 1852, but did not take an active part in its proceedings. Except for a small amount of surveying he had never been directly engaged in civil engineering, his work having been mostly of an executive nature. From 1848 to 1850, he was active in the New England Association of Railroad Superintendents. One of the principal functions of this Association was the study of new equipment and investigation of patented appliances offered to railway officials, and in this work he played a prominent part.

Upon his death the Board of Directors of the Philadelphia, Wilmington & Baltimore R.R. made the following minutes:

> Mr. Hinckley's connection with this Company extended over a period of twenty-three years, he having succeeded S. M. Felton in the Presidency, and during this period, being one third the allotted space of man's life, was devoted to its interests and the welfare of its employees with untiring zeal and energy. He was a scholar of marked ability; a wise and trusted counsellor, widely known, and respected as a man of highest integrity. His untiring industry, tact and skill in working out problems and settling important questions, not only relating to the interests of the Company, but those pertaining to the railway interests of the whole country, were of great value; and in his relations with the officers and employees he was always kind, considerate and courteous. Important as were his services to the Company, their value was enhanced by the loyalty and disinterestedness with which they were rendered.

Reference: Memorials of the Class of 1834 of Harvard College.

EBEN NORTON HORSFORD*

(Born July 27, 1818; died January 1, 1893)

Eben Norton Horsford received a degree in civil engineering in 1838 at Rensselaer Polytechnic Institute. For a few years he served with the New York State Geological Survey, and from 1840 to 1844 he taught mathematics and natural science. In 1845 he was appointed Rumford Professor of the Application of Science to the Useful Arts at Harvard College. In 1847 the Lawrence Scientific School was established at Harvard, and in an advertisement of the school in 1848 *Horsford's* name appeared as Dean of the Faculty. Here he established the department of chemistry and conducted probably the first laboratory courses of importance in that subject in Cambridge. For the next fifteen years he occupied this position as well as taking part in many other activities. In 1863 he retired from Harvard and became head of the Rumford Chemical Works. He maintained his interest in education, however, and made liberal contributions of time and money to aid in the development of libraries and laboratories at Wellesley College.

Eben Norton Horsford was elected an honorary member of the Society on March 22, 1852, the only one elected to this grade in the early years of the Society. He had previously attended meetings of the Society and taken part in a discussion of the paper on the "Use of Lead Service Pipes," by *John H. Blake*. At this meeting *Horsford* exhibited several specimens of lead upon which he had made experiments to determine their serviceability for this purpose.

Horsford was unusually versatile. Graduating as a civil engineer, he then devoted his life to the field of chemistry, first as an educator and later in its practical applications to a successful commercial enterprise. History seems to have been one of his avocations, and the Boston Public Library contains addresses by him on a wide range of subjects. He was a member of the American Academy of Arts and Sciences and was one of the incorporators of the Massachusetts Institute of Technology.

References: Proc., Amer. Acad. of Arts and Sciences, vol. XXVIII, p. 340; Universities and Their Sons, vol. II, p. 382; Dict. of Amer. Biog., vol. IX, p. 236; Nat. Cyclo. of Am. Biog., vol. VI, p. 155.

JOSIAH HUNT

(Born May 6, 1818; died October 3, 1874)

Josiah Hunt was born at Seekonk, Mass., the son of Allen Hunt. After attending Brown University for three years he left to serve on the construction of the Taunton Branch R.R. under Major G. W. Whistler.† From 1836 to 1846 he was connected with the Western (Mass.) R.R., and then superintendent of the Connecticut River R.R. In 1851 he was chief engineer of the New Haven & New London R.R. From 1852 to 1859 he was successively chief engineer of the Terre Haute & Alton R.R., the Great Western R.R. of Illinois (now part of the Wabash system), and the Hannibal & St. Joseph R.R. After completion of construction of the latter road he served as its general superintendent and land agent. His report as land agent in 1859 described in rather glowing terms the desirability of settling in that part of the country, stressing the climate, the productivity of the land, and the rapid growth of the towns with their low taxes and free schools. Finally the company offered ready-made cottages shipped anywhere on the line for $125 to $300, ready for occupancy in five days.

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* Honorary Member, Boston Society of Civil Engineers.

† In 1853 he received the honorary degree of A.M. from Brown University.

Hunt took an active part in the affairs of Hannibal, Mo., serving as mayor of that city from 1868 to 1871 and again in 1873. He was president of the Bank of Hannibal, president of the Board of Education, and prominent in fraternal affairs. During this period he maintained an interest in railroad development, serving as a director of the Hannibal & Central Missouri R.R. and the Hannibal & Naples R.R. *Sereno D. Eaton* made the surveys and was engineer of construction for both of these lines. At the outbreak of the Civil War, *Hunt* organized a battalion in the United States Reserve Corps, and was commissioned as a major.

Josiah Hunt joined the Society on March 4, 1850, but did not remain in New England long enough to take much part in its affairs. He was a founder of the New England Association of Railroad Superintendents and was active in that organization.

The career of *Major Hunt* was a notable one. Following a broad experience in the construction and operation of railroads in New England he went into the Middle West in time to take a prominent part in the rapidly spreading network of railroad lines which were opening up that section of the land. His career in this respect closely paralleled that of *Lucian Tilton*. Through his ability, force and integrity he occupied an important place in the development of that part of the country. His activity in the public affairs of Hannibal was noteworthy. His death at the age of fifty-six was untimely, had he lived another decade he would undoubtedly have achieved a still greater measure of success.

MARTIN BRIMMER INCHES

(Born April 13, 1820; died April 28, 1893)

Martin Brimmer Inches was born in Boston, the son of Henderson Inches and a nephew of Martin Brimmer, mayor of Boston in 1843 and 1844, at the time the discussion of a water supply for the city was reaching fruition. No information is available as to his education or training. The earliest record of him on engineering work is in 1844, when he and a Mr. Newell made a survey under the direction of *Waldo Higginson* for a railroad route from Brattleboro, Vt., via the valley of the West River, and thence across the Green Mountains with a view to a continuation to Rutland and Burlington, Vt. A report of this survey, which included a proposed tunnel 5,070 feet long, together with estimates, was later presented before the Boston Society of Civil Engineers by *Higginson*.

His name appears in the Boston Directory as an engineer from 1846 to 1893, with the exception of a year or two. In 1852 he was located at Albany, N. Y.; it is suggested that he was engaged on railroad work at this time, but no definite data has been secured as to his activities there. In 1854 he made a "Report of a Survey for Water for the City of Worcester (Mass.)." In submitting this report to the city council, the mayor, J. S. C. Knowlton, states that he "fortunately secured the services of *M. B. Inches*, Esq., of Boston, a gentleman of experience as a civil engineer." Two years later he made an additional report to the city of Worcester on "supplying Worcester with water from Henshaw Pond."

Although a member of a family which for years had been prominent in Boston's commercial affairs, it has been found impossible to secure additional information as to his work as a civil engineer. In fact, all of those consulted were surprised to learn that he had been an engineer; they had assumed that his major activities were in connection with commerce and financial interests. No record of his civil engineering activities after 1860 has been found. In view of the fact that his business address was 1 Russia Wharf from 1860 to 1893, it is probable that during that period he devoted most of his time to business affairs related to shipping and commerce.

Martin Brimmer Inches joined the Society on October 2, 1848. He attended a large number of the meetings and took an active interest in the affairs of the Society, although he did not present any papers. He was particularly interested in the development of the library, and served as librarian of the Society for about three years (1852–55).

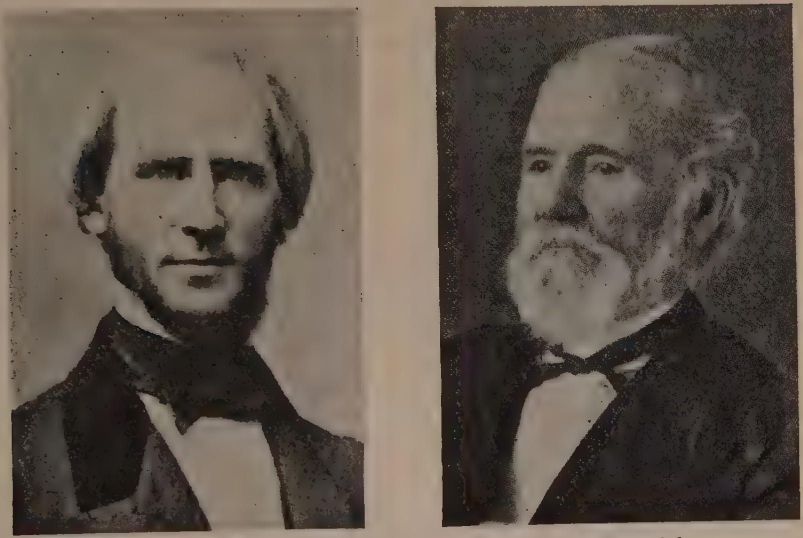
He was at one time (1853) a member of the newly organized American Society of Civil Engineers. It is to be regretted that so little is known about him, but a diligent search has failed to reveal any additional information. It is evident that in his earlier years he was interested in the civil engineering profession, perhaps having entered it through friendship and close association with men like *Waldo Higginson*, under whose direction in 1844 his first civil engineering work is noted. Later in life he appears to have devoted most of his attention to the family business interests. In fact, it has been suggested by a relative that his interest in the Society may have been "purely benevolent;" this, however, does not agree with the record, which shows him taking part in civil engineering work as well as maintaining a keen interest in the Society and its affairs, particularly the development of the library, during the period from 1848 to 1853.

SAMUEL FRANCIS JOHNSON

(Born December 16, 1821; died January 15, 1883)

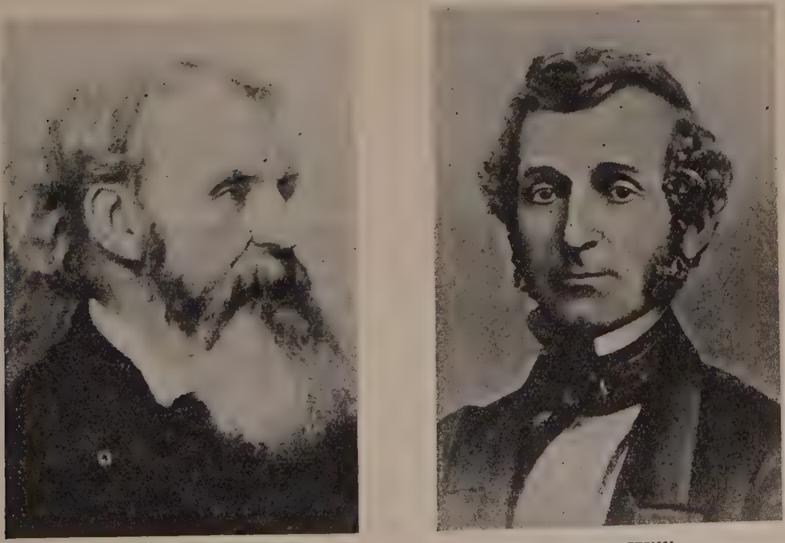
Samuel Francis Johnson was born in Charlestown, Mass., the son of Samuel R. Johnson, a stone mason. He received his training for civil engineering as a student in the offices of Loammi Baldwin and *Samuel M. Felton*. He was on the surveys for several Massachusetts railroads and later was appointed division engineer on the location and construction of the Fitchburg R.R. between Concord and Littleton. He was particular in the character of the work built under him, especially in the matter of masonry — no doubt from his familiarity with his father's vocation. Upon the completion of this work about 1840 he was put in charge of the western part of the construction of the Vermont & Massachusetts R.R. Later he served as engineer and superintendent of the whole road.

Subsequently he was engineer of the Troy & Boston R.R, and completed that road and the depot in Troy. From there he went in 1858 to Chicago and became chief engineer of the Chicago, St. Paul & Fond du Lac R.R. (now Chicago & Northwestern). It was a struggling road, being built on a land grant, and his troubles were great. Later he went to Texas, but with the outbreak of the Civil War, *Johnson* as a northerner found it advisable to give up this work, and he returned to Massachusetts. He became engineer of construction of the Old Colony R.R. and built the extension from Fall River to Newport. Later he built the Portsmouth & Dover R.R. The disease which caused his death in 1883 was said to have resulted from his Texas experience many years earlier.



Franklin Darracott
1820–1895

John H. Blake
1808–1899



Samuel Ashburner
1816–1891

Thomas S. Williams
1812–1874

FIG. 10

Samuel F. Johnson joined the Society on November 5, 1849. At this time his work on the Vermont & Massachusetts R.R. kept him away from Boston, and he took little part in the activities of the Society, although showing his interest by his continued membership and financial support. He was elected an honorary member of the Society on June 20, 1877. *Johnson* was also a member of the New England Association of Railroad Superintendents.

Thomas Doane, who was associated with him, wrote as follows at the time of his death:

> My own knowledge of *Johnson* began in 1842, when I entered Mr. *Felton's* office as a fellow student with him. He was a large and powerful man physically. He was about six feet tall, and weighed about 240 pounds. His deep voice was in consonance with his other powers. He was always nearsighted. He was a great smoker. . . . His physical powers, with determined will, gave him great influence among men with whom he had to do.

Reference: Jour., Assoc. of Eng. Soc., vol. IV, p. 247.

JAMES LAURIE

(Born May 9, 1811; died March 16, 1875)

JAMES LAURIE was born in Scotland and came to this country as a young man with James P. Kirkwood, who had been appointed chief engineer of the Norwich & Worcester R.R. *Laurie* served as engineer on this railroad until 1835, when he became chief engineer. This was probably the first railroad in the country on which a tunnel was built. From 1845 to 1847 he made surveys for the Providence & Plainfield R.R., which was later merged with the Hartford, Providence & Fishkill R.R.

About 1848 he opened an office in Boston, where he remained for a year or two; most of his work was in connection with surveys or construction of railroads, bridges and other engineering projects. In 1849 he became engineer of the Central Railroad of New Jersey, a position he held for about three years. In 1852 he had an office in New York, and his practice was largely in connection with bridges. In 1858 he made an examination of the Nova Scotia R.R. and reported upon its physical layout and method of operation; and in 1859 and 1860 he was engineer for this road and prepared plans for its extension. In 1862 he made elaborate surveys and a voluminous report on the Troy & Greenfield R.R. and the Hoosac Tunnel, being retained by the State of Massachusetts on the tunnel project for several years.

In 1862 he was also chief engineer of the New Haven, Hartford & Springfield R.R., and designed what is probably his greatest work, an iron lattice bridge across the Connecticut River at Warehouse Point. After the completion of this bridge he retired except for occasional consulting engagements.

James Laurie attended the informal meetings which led to the founding of the Society on July 3, 1848, at which time he was elected a director, serving until 1850. His paper on the "Coal and Iron Trade of Great Britain and the United States" was the first one to be presented before the Society. This was printed in full in the "Mining Journal and American Railroad Gazette" (Boston), and in the same issue the Society received favorable comment on its organization and its likelihood of usefulness to the civil engineering profession and to the community.

Laurie's name is also closely associated with the American Society of Civil Engineers, of which he was not only a founder member but also the first president. He served on the committee which prepared its constitution and by-laws. The similarity between these and the original constitution and by-laws of the Boston Society of Civil Engineers, adopted four years earlier, was probably due to his influence. Another coincidence is of interest, — he presented the first paper before the American Society as well as before the Boston Society. His paper before the American Society was on the subject of "The Relief of Broadway," and dealt with a plan for placing railway tracks above the level of the street. In 1855, the American Society of Civil Engineers ceased holding meetings, and was inactive until resuscitated in 1867 pursuant to a call of the president, *James Laurie*. At the annual board meeting held on November 6, 1867, the following vote was passed:

> *Resolved*, That we tender our thanks to Mr. *James Laurie* for his faithful services as our president, for his efforts to re-establish and reorganize this Society on a basis which gives promise of a successful and useful continuance, and particularly for his care of our friends, to which we are greatly indebted for our present unencumbered and hopeful position.

The *James Laurie* Prize, for a paper describing accomplished works of construction, was established in his honor, October 1, 1912, by the American Society of Civil Engineers.

References: Trans., Amer. Soc. of Civil Eng., vol. XXXVII, p. 553; Dict. of Am. Biog., vol. XI, p. 37; Nat. Cyclo. of Am. Biog., vol. IX, p. 38.

HENRY SWASEY McKEAN

(Born February 9, 1810; died May 17, 1857)

Henry Swasey McKean was born in Cambridge, Mass., the son of Rev. Joseph McKean who was at one time Boylston Professor of Rhetoric and Oratory at Harvard College. His early education was received in Cambridge and at the Boston English High School. He graduated from Harvard in 1828, with high honors, particularly in mathematics and the classics. Although he entered the Law School he did not complete the course as he had decided not to follow that profession. From 1830 to 1835 he served as a tutor at Harvard; he received an A.M. degree in 1831. He was unusually well qualified for the profession of civil engineering. He had received a good foundation in mathematics, a subject in which he was particularly proficient, and he was an excellent draftsman. He entered the office of Loammi Baldwin where he received a theoretical and practical training. His earliest civil engineering work appears to have been on a railroad survey in Georgia, very likely with *Waldo Higginson* on the railroad built by the state. For the next few years he lived in the vicinity of New York. During this period he served for a time as librarian of the Mercantile Library Association in New York, and at another time as tutor for a family living in New Jersey.

With the construction of the new water supply for Boston, he returned to Massachusetts and served as resident engineer on the second division of the aqueduct, 26,453 feet long, under *E. S. Chesbrough*, who was chief engineer on the western division of the project. He formed a deep friendship with *Chesbrough* which had an important influence on him throughout the rest of his life. After the completion of the aqueduct *Chesbrough* served for one year as water commissioner and then became city engineer of Boston in 1850. In 1852 *McKean* became assistant city engineer of Boston, a position he held until *Chesbrough* resigned in 1855 to become chief engineer of the Board of Sewer Commissioners of Chicago. When *Chesbrough* left for Chicago, *McKean* resigned and went into private practice. Apparently this work was not entirely satisfactory, and he contemplated a change to some form of literary employment. He had always been sensitive and inclined to melancholy, and on May 17, 1857, he took his own life.

Henry Swasey McKean was one of the five men who attended the first informal meeting which led to the formation of the Society. He acted as secretary while *Chesbrough* presided at these preliminary meetings. He served on the committee which prepared the constitution and by-laws of the Society. Although attending the meetings he did not take an active part in the presentation or discussion of papers.

McKean's success in life, as the word is commonly understood, was not commensurate with his talents. He was of an unusual and delicate nature, hardly zealous enough in putting forth his claims for the recognition he deserved. Without doubt his literary gifts were considerable, and he might well have met with greater success and personal satisfaction if they had been given an opportunity to play a greater part in his life. In 1833, while a tutor at Harvard, he did some writing under the pseudonym of "John Smith, A.M."* His personal appearance was striking, — tall, thin and angular in figure. As he walked about the streets he is said to have reminded one of the portraits and statues of Dante.

Reference: Palmer's Necrology, Biographical Contributions of Harvard University, p. 191.

SAMUEL NOTT

(Born April 28, 1815; died October 1, 1899)

Samuel Nott was born in Bombay, India, the son of Rev. Samuel Nott, who was one of the five students whose desire to become missionaries resulted in the formation of the American Society for Foreign Missions in 1810. Owing to his father's illness, the family returned in 1816 to the United States. At the age of eighteen he became a rodman on the construction of the Boston & Worcester R.R. under Colonel Fessenden. Soon after this he served as division engineer on the Eastern R.R., of which Colonel Fessenden was in charge. *Nott* was first located at Lynn, Mass.; later (1839) at Salem where he had charge of the construction of the Salem Tunnel; and then at Newburyport, where he built the bridge across the Merrimac River which served until 1867, when it was replaced by a more substantial structure designed by *T. Willis Pratt.* In 1841 he served with the Portsmouth, Saco & Portland R.R. (an extension of the Eastern R.R.) and built the line from Portsmouth, N. H., to North Berwick, Maine.

About 1845 he opened an office in Boston for general engineering practice; most of his work was in the field of railroad location and construction. From 1846 to 1852 he and *William P. Parrott* were in partnership, *Nott* apparently devoting most of his attention to railroad projects, and *Parrott* to land and water-front development at Boston. In 1845, *Nott* made surveys and estimates for the Lowell & Lawrence R.R. The next year he was engaged in a project for a relocation of the main line of the Boston & Maine R.R. to reach Lawrence. In 1848 he served as chief engineer of the Manchester (N. H.) and Lawrence R.R. In 1849–50 the Portsmouth and Concord R.R., which had been partly constructed, was taken over by *Nott* and completed, although under a heavy load of personal liability due to its being inadequately financed.

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* The Boston Public Library contains a translation by him from German of "The Lover of Nature — a Tale," from Ludwig Tieck.

In 1852 he made surveys for an extension of the Hartford, Providence & Fishkill R.R., of which *Samuel Ashburner* was chief engineer. In 1857 he was made superintendent of this railroad, a position he held for over twenty years. He took over the road under adverse circumstances, with no credit, in a time of depression. When he left, many years later, the line was in better physical shape and its earning power much improved. From November, 1880, to May, 1882, he was superintendent of the Hartford Water Works, after which he apparently retired.

Samuel Nott took part in the informal meetings and became a member of the Society at its founding on July 3, 1848. He was elected a director at that time and served until March 6, 1849, when he was elected secretary and filled that office until the reorganization of the Society in 1874 (although for the period from 1861 to 1874 the Society was inactive). Except when located away from Boston, he attended almost every meeting of the Society and served on numerous committees. As secretary he was in large measure responsible for its affairs. In 1849 he and *Parrott* presented a paper "On the Destruction of the Dam at Hadley Falls." Later he served on a committee which reported upon experiments to determine the merits of "Baker's Improved Furnace." He was elected an honorary member of the Society on May 20, 1891.

From his early youth *Samuel Nott* showed a strong devotion to duty, an honesty of purpose, and an ability to carry through a hard task. These characteristics were dominant throughout his professional career. He maintained an interest in missionary work, in the atmosphere of which he had been brought up, and devoted much time to charitable and missionary activities during his many years at Hartford. His last meeting with the Boston Society of Civil Engineers occurred on November 11, 1898, at the Semi-Centennial Celebration of the founding of the Society. On this occasion, *Desmond FitzGerald*, former president, delivered an address on the history of the organization, in which he paid high tribute to *Nott's* devoted service as secretary in the early years of the Society. It seems eminently fitting that *Samuel Nott*, then over eighty years of age, could be present and take part in this ceremony which was his last contact with the Society he had founded half a century earlier.

Reference: Jour., Assoc. of Eng. Soc., vol. XXIV, p. 227.

GEORGE ALANSON PARKER

(Born May 8, 1822; died April 20, 1887)

George Alanson Parker was born at Concord, N. H., the son of Joseph Parker. At the age of eleven, he came to Charlestown, Mass., to attend a private school run by *Samuel M. Felton*. Four years later he became a draftsman in the office of Loammi Baldwin, and the next year, not yet sixteen years old, he was appointed a teacher in a public school in Charlestown. He later returned to Baldwin's office, with whom and with his successor, *Samuel M. Felton*, he remained until 1841, when he went with the Concord R.R. For a year he worked as deputy-surveyor in the West, returning to become a partner with *Felton*, with whom for the next six years he was engaged in a general civil engineering practice.

In 1853 he went to Europe, where he met many notable persons, including Thackeray, the Brownings and others. Upon his return he became superintendent of the

Philadelphia, Wilmington & Baltimore R.R. of which his former partner, *Felton*, was now the president. He returned to Massachusetts in 1857 for a short period, but in 1859 became engineer in charge of the proposed southern connections of the Baltimore & Ohio R.R. at Washington, D. C.; these were held up by the Civil War. In 1862 the need of an unbroken route between the North and the South was so great that the Susquehanna bridge project, which he had planned to carry out in 1855, was resumed and he was put in charge of the work. This bridge had a total length of 3,273 feet and offered many problems of unusual difficulty. Four years were required to complete it, and the cost was almost $2,000,000.

In 1865, *Felton* was forced to retire from the presidency of the Philadelphia, Wilmington & Baltimore R.R. due to ill health, and *Parker* served for a short time as acting president. For the next three years he was engaged in the construction of railroads in Maryland and Delaware. He returned to Massachusetts, and in 1870 was elected to the Legislature as an independent, serving three terms. During this period he took an important part in connection with legislation affecting the railroads. At about this time he was building the Lancaster R.R., the failure of which, through no fault of his own, was the severest trial of his business life. Later he made surveys for other New England railroad extensions following which he was engaged in railroad construction in the South. During this period he devised a scheme for a bridge across Boston Harbor, the plan of which mysteriously disappeared from the Boston City Hall, subsequently to be published as original in an English periodical. In 1882 he was consulting engineer for the Baltimore and Ohio R.R. His last railroad work was the construction of the Zanesville & Ohio River R.R., which he completed only a few months before his death.

George Alanson Parker joined the Society on March 22, 1852, but owing to his absence from Boston was unable to take active part in the meetings. He was elected an honorary member of the Society on June 20, 1877. *Parker* was also a member of the American Society of Civil Engineers.

The interest in public affairs, so much in evidence in his life, was inherited by his son, Herbert Parker, who served for many years as Attorney General of Massachusetts, and by his granddaughter, Katherine V. Parker, now a member of the Massachusetts legislature. Gifted with much natural aptitude for his profession, his work was marked by excellent judgment, by great skill in planning, and by unwearied diligence in execution. Few members of the profession have had a more intimate acquaintance with the history and literature of its great achievements, or have appreciated more fully its dignity and usefulness. Born in humble circumstances, he owed his success entirely to his integrity, his industry and his ability. He had a great devotion to everything pertaining to country life, and his happiest hours were spent upon his farm at Lancaster, Mass.

Reference: Jour., Assoc. of Eng. Soc., vol. VIII, p. 334.

WILLIAM PEARCE PARROTT

(Born March 2, 1810; died March 4, 1868)

WILLIAM PEARCE PARROTT was a son of William W. Parrott of Portsmouth, N. H., and a grandson of William Pearce, a prominent citizen of Gloucester, Mass. He attended Dummer Academy, Byfield, Mass., and later entered Norwich University,* Norwich, Vt., from which he graduated in 1825. Here he learned the fundamentals of the natural sciences and probably received some training in civil engineering. His early activities were along shipping and commercial lines. The title often used, *Captain Parrott*, was apparently due to his having served as a sea captain for his grandfather. In 1835 he was listed in the Boston Directory under Parrott & Hughes, merchants, at 30 Central Wharf; this firm was interested in trade with Surinam.

The first record found of his civil engineering work was in 1844 at Bangor, Maine, where he was engaged in making surveys and maps of the public lands for the state land office. In 1845 or 1846 he moved to Boston, where he became a partner of *Samuel Nott*, who had been engaged in railroad surveys and construction since the first railroads were built in 1833. This partnership continued until 1851 when *Nott* went to Hartford. These two civil engineers made surveys and estimates for the Manchester & Lawrence R.R. and a number of others. Later (1854) *Parrott* was engineer for the Eastern R.R. for its extension to Boston to avoid the ferry from East Boston. In much of his railroad work he served as a consultant rather than as a regular employee of the railroad. In 1853, at the request of *Isaac Hinckley*, a member of a stockholder's committee, *Parrott* reported on the general condition of the Vermont Central R.R. He had earlier made a similar investigation concerning the physical layout of the Boston & Maine R.R. for the stockholders. In 1858 and 1859 *Parrott* served as president of the Vermont & Canada R.R., a short line under lease to the Vermont Central R.R.

Railroad work, however, formed but a part of *Parrott's* professional activities. During his civil engineering career at Boston (1845–68), he took an active part in the development of Boston's land and water front. He was associated with *E. S. Chesbrough* in studies for the best method of draining the Back Bay. *Chesbrough* in 1868 gave eloquent testimony as to the ability shown by *Parrott* in this field of his profession:

> This gave me an opportunity of learning much better than anything, before or since, the character of his mind, and it increased my respect for him very much, a respect which has continued to this day. On some points that came before us there was little or no experience in this country to guide us, and the best information we could obtain was from parliamentary documents. These were very voluminous and contained such conflicting views that it was very difficult to decide in some cases who was right, and consequently whom to follow. In reviewing that whole matter in the light of more recent investigations, I have felt that *Captain Parrott's* judgment was very correct, and that I was very fortunate in my associate.

Other activities in which he took part are indicated by the titles of some of the plans and maps prepared under his supervision.†

> Map of East Boston, 1849 — plans and profiles for establishing streets; Plan of Back Bay and Vicinity — made for Commissioners of Boston Harbor and Back Bay; Proposed System of Sewerage — Back Bay and Vicinity; Plan of Proposed Docks at South Boston.

William P. Parrott was probably the most active member of the early Boston Society of Civil Engineers. He attended the informal meetings which led to the founding of the Society on July 3, 1848, and after that was present at all but one meeting until the Society ceased its first period of activity. He served as treasurer from 1848 to 1853, when he was elected vice-president, a position he held until his death. In 1849 he and *Nott* made an examination of the "Failure of the Dam at Hadley Falls,

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* Probably known as Partridge's Military School (or Academy) at that time.

† Boston City Engineer's Report for 1902.

Mass.," and reported on it to the Society. In 1850 *Borden, Parrott* and *Nott* reported on "Baker's Improved Furnace." Locomotive boiler explosions were distressingly frequent in these days and were the subject of much investigation. *Parrott* served on committees of the Society which made investigations in a number of these cases, and the resulting reports were not only presented to the Society but were also printed in full in the Boston daily papers.

One of the surprising features of *Parrott's* career is the fact that in the midst of a busy life he was not only able to guide the affairs of the Boston Society of Civil Engineers, but in addition to serve as Secretary of the New England Association of Railroad Superintendents. This organization was also founded in 1848 and had an active existence until 1857, and about one third of the members of the Boston Society of Civil Engineers were also members of the railroad group, which for part of its life occupied rooms adjacent to the Society, and the library was maintained in common.

Parrott was interested in educational affairs and in the development of the profession of civil engineering. From 1856 until his death he was a member of the Massachusetts Charitable Mechanics Association. He was elected a member of the American Society of Civil Engineers in 1853, but does not appear to have taken an active part in that Society. He was one of the incorporators of the Massachusetts Institute of Technology in 1861.

Following his death a tribute was read from the chancel of the Church of the Advent, where he had been for many years a distinguished member. This told of his habits as simple, grave, tender, sympathetic and devotional. As a friend he was always true and reliable and beyond the reach of any motives or influences of more worldly honor or office to corrupt the fidelity of his friendship.

At a special meeting of the members of the late New England Association of Railroad Superintendents and the Boston Society of Civil Engineers, at which *Martin B. Inches* served as secretary, the following resolutions were adopted:

As it has pleased God to remove by death our late associate, Capt. Wm. P. Parrott;

Resolved, First, That in losing him, the profession in New England, to which he gave the flower of his life and the maturity of his powers, has lost one of its most learned, as well as one of its ablest and most energetic members.

Second, That we recognize in him a man always high minded and honorable, and recall with gratitude the many occasions in which he cheerfully imparted to his brethren from his abundant stores of knowledge and science.

Third, That the Railroad Companies of New England owe him an unrequited debt of gratitude, in that he served for many years as Secretary of the New England Association of Railroad Superintendents, and in that capacity performed faithful and untiring labors in their behalf, without reward, except in the pleasure of seeing the advance of practical improvement in the conduct of railroads.

Fourth, That in view of the obligations of New England Railroad Companies to him, the Secretary of this meeting and Mr. *Samuel Nott* be requested to serve as a committee to transmit an authentic copy of these resolutions to the Boards of Directors of the principal railways who belonged to the Association, with the request that they would preserve them among their records.

Fifth, That the Secretary of this meeting is requested to communicate a copy of these resolutions to the family of *Capt. Parrott*, with the assurance of our sincere sympathy in their great bereavement.

THOMAS WILLIS PRATT

(Born July 4, 1812; died July, 1875)

T. Willis Pratt was born in Boston, the son of Caleb Pratt, a well-known architect. He attended the Boston English High School and Rennselaer School. Although not completing the course at Rennselaer, he is said to have exhibited particular skill in the natural sciences. His first civil engineering work was with Loammi Baldwin in the construction of the dry docks at the navy yards at Charlestown, Mass., and Norfolk, Va. His early railroad work was on the Boston & Lowell R.R. and the Boston & Worcester R.R. Later he was division engineer on the construction of the Norwich & Worcester R.R. under *James Laurie*, and subsequently served as superintendent. In 1845 he was engineer for the Providence & Worcester R.R., and later, superintendent. He served as superintendent of the Hartford & New Haven R.R. *Pratt* was next chief engineer of the Middletown Branch R.R., also of the "Air Line" in Connecticut and of the Gloucester Branch of the Eastern R.R. He then became chief engineer and superintendent of the New York & Boston R.R., and in 1871 he built the Conway & Great Falls branch of the Eastern R.R. For many years he served as engineer of the Eastern R.R. and was responsible for the design of many of its bridges. In 1867 he built the new Newburyport bridge, which replaced the original one built by *Samuel Nott* many years earlier.

Pratt's name is well known to all civil engineers through the "Pratt" truss which he originated, and for which a patent was awarded in 1844 and extended in 1858. *Pratt* was said to have derived little pecuniary benefit from this invention, but continued to make inventions and patent them throughout his whole life. In addition to numerous improvements in the design of bridges, he made designs for improved boilers, devices for propelling ships, and many others.

T. Willis Pratt was one of the founder members of the Society. He did not present any papers before the Society. Although very active in engineering matters and the holder of many patents, he was reticent about publishing his works and probably little of his technical writings are in print. He took an active part in the reorganization of the Society in 1874. He became a member of the American Society of Civil Engineers on November 2, 1853, and served on the second Board of Directors. In 1870 he became a Fellow of that Society.

References: Nat. Cyclo. of Am. Biog., vol. XXII, p. 275; Dict. of Am. Biog., vol. XV, p. 179; and *Proc.*, Am. Soc. of Civil Eng., vol. I, p. 332.

THEOPHILUS E. SICKELS

(Born 1822; died February 4, 1885)

Theophilus E. Sickels was the son of Dr. John Sickels of New York City. He received an academic education, excelling in mathematics and natural science. At the age of seventeen he became an assistant in the construction of the Croton Aqueduct under John B. Jervis. Later he worked on the Erie R.R. and upon the enlargement of the Erie Canal. He came to Boston in 1846 and was a resident engineer on the Cochituate Aqueduct under *E. S. Chesbrough*. Following the completion of the Boston water supply he engaged in railroad work for the next thirty years.

In 1851 he was chief engineer of the West Chester & Philadelphia R.R., and then chief engineer of the Philadelphia & Baltimore Central R.R. From about 1857 to 1860 he was constructing the Hannibal & St. Joseph R.R., probably as engineer for the contractor. From 1869 to 1872 *Sickels* was chief engineer of the Union Pacific R.R. and built the first bridge across the Missouri River at Omaha, Neb., one of the first bridges in this country with iron tubular piers. Later for a short time he was general superintendent for the Union Pacific, resigning that office in 1874, but holding a position as consulting engineer for the road for a number of years. During the last ten years of his life he acted as a consulting engineer on projects throughout the United States. He was consulting engineer for the South Pennsylvania R.R., and in an inspection of the tunnels under construction on that road inhaled the fumes from an explosion, from the effects of which he never fully recovered.

Theophilus E. Sickels was one of the founders of the Society. Although not presenting any papers or holding office, he attended the meetings and took part in the discussions during the first year or two. Soon after the completion of the Cochituate Aqueduct he went to Pennsylvania, and his entire subsequent career was outside of New England. He was elected an honorary member of the Society on June 20, 1877. He joined the American Society of Civil Engineers in 1872, and in 1878 was the representative of that Society at the Paris Exposition. *Sickels*' marked characteristics were his strong good sense and independent original judgment which made him successful where others failed. Mr. C. S. Stebbins of the Union Pacific R.R. said of him:

> Mr. *Sickels* was distinguished by the simplicity and abstemiousness of his personal habits, the warmth of his domestic affection, his social nature, his ready sympathy and his active and unostentatious charity, the extent of which was never known except to himself and to its recipients, unless divulged by accidental circumstances. The death of few men is mourned with a sense of personal loss by so wide a circle of friends unconnected by ties of relationship or interest.

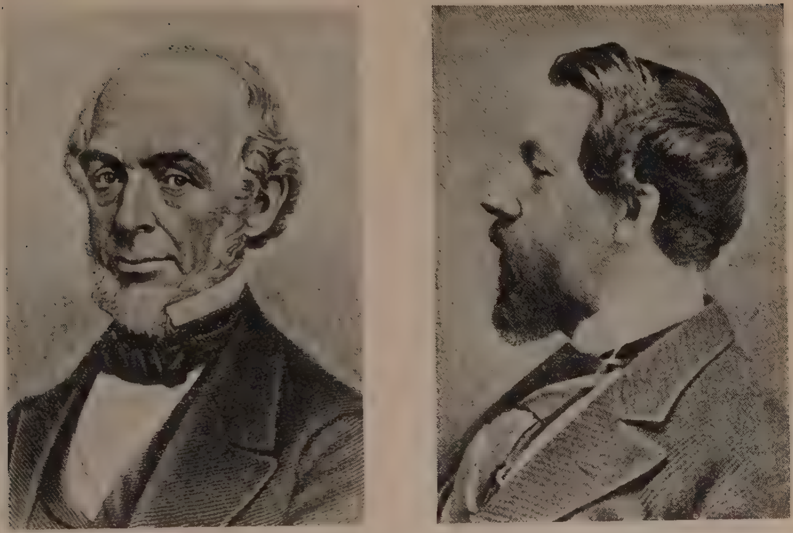
References: Jour., Assoc. of Eng. Soc., vol. VI, p. 232; *Proc.*, Am. Soc. of Civil Eng., vol. XI, p. 130.

LUCIAN TILTON

(Born July 10, 1811; died March 19, 1877)

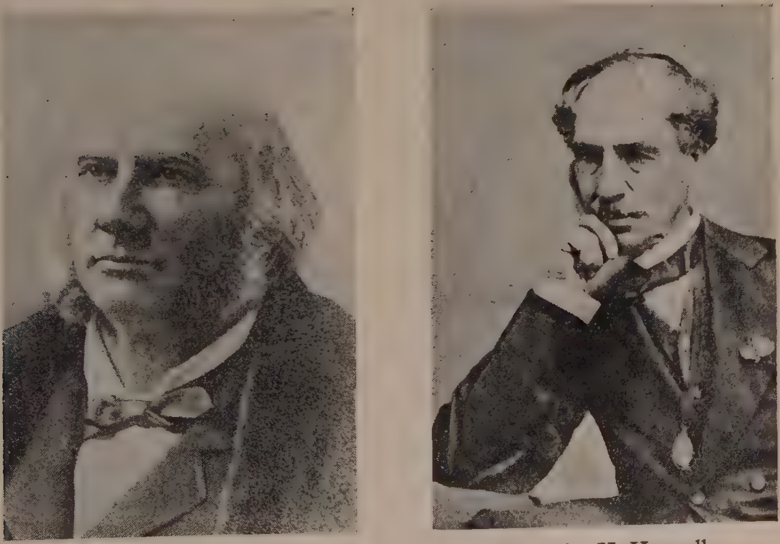
Lucian Tilton, who was born at Hampton Falls, N. H., was a direct descendant of William Tilton who settled in Lynn, Mass., about 1630. His grandfather was a surgeon in the Revolutionary Army, and his father, John Tilton, served in the War of 1812. His Christian name appears as *Lucian* in all records of him in New England, whereas it is given as *Lucien* in references to him in the Middle West. The former is believed correct, since it agrees with his signature affixed to the Constitution of the Society as well as with the genealogical records of the family.

No information has been found concerning his education and early professional experience. It is almost certain that he took part in his earlier years in the surveys and construction of the railroads which were spreading so rapidly in New England in the period from 1835 to 1848. In 1848 he was engineer for the Cheshire R.R., and later superintendent. In 1849 he and *Josiah Hunt* acted as consulting engineers for the Ashuelot R.R. in New Hampshire. In 1850 *Tilton* was elected superintendent of the Fitchburg R.R., a position which he held until 1853, when he resigned and probably went to the Middle West at that time.



Marshall Conant
1801–1873

Robert H. Eddy
1812–1887



Eben N. Horsford
1818–1893

Charles H. Haswell
1809–1907

FIG. 11

Tilton's life was intimately connected with the development of the railroads of Illinois and neighboring States, particularly with those lines which later formed important parts of the Wabash system. While the records are incomplete as to the details for the next three or four years, it is believed that he was chief engineer and superintendent of the Toledo, Wabash & Western R.R.; in 1857 he was vice-president of that railroad, which extended from Toledo, Ohio, to Danville, Ill., on the Indiana–Illinois line. From 1859 to 1862, at least, he was president of the "Great Western Railroad Company of 1859," which extended westward from Danville to Naples on the Illinois River. On May 16, 1865, he was elected president of the Illinois & Southern Iowa R.R. He was appointed consulting engineer for the Toledo, Wabash & Western R.R. in 1865, and in the same year became a director of that railroad. *Tilton* made his home in Springfield, Ill., for many years. When President Abraham Lincoln went to Washington in 1861 he leased his house to *Tilton* who remained there until the property was taken in charge by the administrator for the Lincoln estate. For at least a decade his railroad activities were all connected with lines which later were consolidated into the Wabash. In 1879 the name of the town of Brant, near Danville, was changed to Tilton. It is believed that this was done in honor of *Lucian Tilton*.*

Tilton moved to Chicago about 1869, where he spent the remainder of his life. He served as a director of the Illinois Central R.R. from 1871 to 1875. In 1875 he was vice-president of the North Chicago Railway Company. The following is quoted from an obituary notice in the "Chicago Tribune:"

> Col. *Lucien Tilton*, a well-known citizen, and one of the most eminent engineers in the Northwest, was buried from his late residence, No. 297 Oak Street. He settled in this State a decade ago, and aided materially by his engineering skill in developing her resources. For a long time he resided in Springfield, and some eight years ago he retired from active business pursuits, and took up his residence in this city. Mr. *Tilton* was a courteous gentleman, who drew about him a wide circle of friends. In his hospitality he was bounteous and his charity was proverbial. He died leaving behind him a reputation without a blemish. The Rev. Dr. Collyer officiated at the funeral ceremonies and touched upon the life and character of the deceased, and alluded to the fact that during thirty years of an active business life he had never overdrawn his bank account or given a note. Mr. *Tilton* leaves a fortune of fully a quarter of a million dollars, mainly in cash and bonds, and it is stated a portion consists of $60,000 in gold, but recently purchased.

The foregoing summary of *Tilton's* activities marks him as one of the pioneers in the early railroad development of Illinois. In this respect his career was much like that of *Josiah Hunt*. Like many others he had received his early experience in railroad work in New England, which had been covered with a network of lines (2,300 miles) by 1850. In the next ten years the railroad mileage of Illinois increased from 22 miles to over 2,700.

Lucian Tilton was a founder member both of the Boston Society of Civil Engineers and of the New England Association of Railroad Superintendents, and served as president of the latter organization in 1853.

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* One historian of the Tilton family genealogy believes this name was given in honor of Henry Tilton, a distant relative of Lucian's, who was connected with the Northern Cross, an early Illinois railroad.

WILLIAM SCOLLAY WHITWELL

(Born May 23, 1809; died October 31, 1899)

William Scollay Whitwell was born at Augusta, Maine, and apparently received his early education in the public schools of Boston. No information is available as to what training he may have had in civil engineering. There is evidence that he received practical experience in machine shops in New England, particularly at Dover, N. H. His first civil engineering work of which record is available is on the Concord R.R. Later he had charge of a division of the survey for the Western & Atlantic R.R. (or an extension of it), between Atlanta, Ga., and Chattanooga, Tenn. He also surveyed for a railroad location from Tallahassee across to the east coast. These surveys in the South were probably in the period from 1841 to 1843. During 1844 and 1845, *Whitwell* was chief engineer for the construction of the western end of the Fitchburg R.R., while *Samuel M. Felton* was in charge of the eastern section.

In 1846 he was appointed chief engineer for the eastern division of the Cochituate Water Supply for the city of Boston; this section included all work east of the Brookline reservoir, including the Beacon Hill reservoir in Boston and the distribution system. On October 25, 1848, the city of Boston celebrated the "introduction of pure water into Boston" with appropriate ceremonies on Boston Common. The Beacon Hill reservoir was completed the following year, as well as a reservoir in South Boston.

On January 4, 1850, the First Cochituate Water Board took place, with the election of *E. S. Chesbrough*, *W. S. Whitwell* and J. Avery Richards to constitute the Board. *Chesbrough* became commissioner in charge of operation, with *Whitwell* as engineer. This Board terminated its service late in that same year and a new form of organization took its place. *Whitwell's* connection with Boston's water supply ceased at this time, and he served as superintendent of the Cheshire R.R. in 1852. From about 1852 to 1857 he maintained a partnership in civil engineering work with J. B. Henck, but during this period was also actively engaged in the affairs of the Boston Water Power Company. He was treasurer and president of that company in the period from 1857 to 1859, and from 1860 to 1874 he was treasurer of the Boston & Roxbury Mill Corporation. For some time after this he was active in the affairs of these corporations engaged in the successful development of land in Boston. In his latter years, *Whitwell* traveled extensively both here and abroad.

William Scollay Whitwell attended all of the informal meetings which led to the founding of the Society on July 3, 1848, and at that time was elected a director, an office he held until 1852. He attended very regularly during the early years and was active on committees. He presented papers on "The Mode Adopted for Carrying the Water Pipe from Boston to South Boston," and on "The Construction of the Beacon Hill Reservoir." On June 20, 1877, he was elected an honorary member.

Whitwell took an active interest in the anti-slavery agitation and joined the ranks of the abolitionists. Like many other members of the early Society he devoted the first part of his professional life to the practice of civil engineering, and in his later years engaged very successfully in business and commercial pursuits into which his earlier engineering activities and contacts had led him.

Reference: Jour., Assoc. of Eng. Soc., vol. XXIV, p. 232.

THOMAS SCOTT WILLIAMS

(Born February 26, 1812; died December 29, 1874)

Thomas Scott Williams was born at Lebanon, Conn. He had expected to enter Harvard or Yale as his father and grandfather had done, but with a spirit of unselfishness which characterized his life, he gave up this idea in order that his younger brothers and sisters might receive an education. He became interested in surveying and civil engineering during a year spent in Philadelphia, and when twenty years old came to Boston in search of a position on the new railroad (Boston & Lowell) which was then being built. He succeeded in this purpose, and soon was placed in responsible charge of construction of a section at Woburn, Mass. He describes some of his duties on this job and tells of his desire to improve his knowledge of mathematics in a letter to his sister:

> Mr. Haworth sailed for England on yesterday morning. I write myself, T. S. W., Resident Engineer, B & L Railroad at Woburn. Yes, I am now in Mr. Haworth's place and have charge of about six or seven miles of the railroad; everything that is done on this part is done by myself. I have a great deal of care and great responsibility. All bridges, culverts, ditches, etc., that are built I have to stake out and see that they are built right, give levels, run lines, measure all excavation of bridges, etc. In fact, I have as much to do as I can do, and it keeps me busy all the time. All that I want is a good knowledge of mathematics. That I am resolved to have.
>
> I have purchased Euler's Algebra and some few mathematical books and am trying to get a knowledge of the algebra, etc. I hope I shall be able to so take care of my part of the road as to give satisfaction to *Mr. Baldwin*. I like him exceeding much. He seems to try to do all he can to help me.

During the next few years he was engaged in the construction of railroads which were being developed with great rapidity in Massachusetts during the period from 1835 to 1845. On May 20, 1846, he was engaged as temporary engineer to examine and make soundings from Long Pond to Morse's Pond. A little later *E. S. Chesbrough* and *W. S. Whitwell* were selected as chief engineers of the western and eastern divisions for the construction of the project, and *Williams* was appointed as resident engineer of the third section, 23,000 feet long, including the Newton and Brookline tunnels and the reservoir at Brookline.

Williams later returned to railroading and in 1848 became superintendent of the Sullivan R.R. which extended from Bellows Falls to Windsor, Vt. In 1850 he became superintendent of the Boston & Maine R.R., a position he held for about five years. Announcing his resignation the directors referred to him as "a talented, experienced and faithful officer." Commercial pursuits next took his attention and he became a partner in the firm of Williams & Page, dealers in railroad supplies.

Thomas S. Williams took part in the informal meetings which led to the founding of the Society on July 3, 1848. While in Boston he attended the meetings regularly, but did not present any papers. He was a member of the New England Association of Railroad Superintendents, serving as vice-president in 1853. *Williams* was of a deeply religious nature, a fact clearly shown in a number of personal letters written to members of his family. He was active in civic affairs and his name is closely identified with Newton, where he lived for many years. The Williams School in Auburndale (Newton), Mass., named after him, contains a portrait of him made possible through a gift of his sister. Though lacking a college education, he devoted much time to study and reading, and was a man of breadth and culture. He made warm and lasting friendships, attracting every one to himself by his genial manner and overflowing interest in all that concerned him.

RECENT DEVELOPMENTS IN THE USE OF TIMBER IN ENGINEERING CONSTRUCTION

By Frank P. Cartwright *

(Presented at a meeting of the Boston Society of Civil Engineers on February 19, 1936)

A certain amount of historical background is needed to appreciate the recent improvements in the use of structural timber.

During the early periods of industrial development and growth of transportation in this country, wood was for many purposes the only structural material. It was available everywhere, in practically unlimited quantities, and at low cost in the economic terms of those times. It was used lavishly and often with no great skill or forethought directed to capitalize its full possibilities. Numerous timber structures have nevertheless survived, particularly in New England, to demonstrate by a century or more of service that wood has good structural possibilities, and that these possibilities could be realized even with the somewhat empirical design practice of those early days.

The advent of steel and concrete as we know them undoubtedly did much to turn engineers' minds from wood. These new materials made it possible to design and build the greater and more complicated structures, higher buildings and longer spans, demanded by our growing civilization. Their refinement and economical use made strict demands on engineering skill. Endless research and vigilance were necessary to overcome their inherent difficulties and avoid mishaps. Manufacturers and contractors co-operated in these efforts with remarkable vision. The schools were full of the new theory and practice. It is no overstatement to say that in those days the products of the forest, as structural material, fell a little farther into the background than was justified, and that steel and concrete, to say nothing of materials more recently developed, were frequently employed for structures in which timber would have been a better choice.

These exaggerated trends in time correct themselves. From the contact which the Timber Engineering Company maintains with the structural field, it is quite apparent that for some years in-

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* Member of Engineering Staff, National Lumber Manufacturers Association, and of the Timber Engineering Company, Washington, D. C.

terest in the intelligent and judicious use of timber as a structural material has been steadily increasing, both in technical schools and in engineering circles generally. This may be due in part to the swing of the pendulum, but it is undoubtedly due much more to certain items of genuine progress in the supply and utilization of the material. Before discussing these developments briefly, attention should be directed to an institution which has had a helpful influence on the whole forest problem and on the use and improvement of one of our major national resources — an influence out of all proportion to its limited personnel, facilities, and relatively short period of activity.

The Forest Products Laboratory has had a leading part in every important development and improvement in the preparation and use of wood. It has carried on a great part of the research and investigation which summarizes the present knowledge of the many species, their physical characteristics and their peculiar adaptabilities. Its work has been liberally utilized by the industry and by architects and engineers working with wood.

Timber Grading for Strength

Probably the most important development of recent years in the structural timber field has been the evolution and general recognition of accurate, dependable grading for strength. Because of variations in the wood quality, number and size of knots, cross grain, etc., one timber of a species may be several times as strong as another. If timbers are not graded according to these strength factors, working stresses based on the poorest pieces must be used. Grading for strength makes it possible to use working stresses economically consistent with the average strength of the grade described.

The fundamental procedure in arriving at strength grades is as follows:

The known average strength characteristics of clear, green, straight-grained wood are taken as a basis. The influence of knots, angle of grain, density, and shakes and checks is known quantitatively from a great volume of testing, done principally by the Forest Products Laboratory. By grading rules limiting the number, size and location of these strength factors, the minimum strength of timbers meeting the grading rule description can be anticipated with as much accuracy as the strength of any other construction material. A 1-inch knot, for example, in a 6-inch column means that the column rates 84 per cent of the allowable stress for clear timber. If this same column has a

1 in 10 slope of grain, its allowable stress is only 74 per cent that of clear, straight-grained timber.

The system in all its ramifications, as described in Department of Agriculture Publication No. 185,[*] is not as simple as this sounds. It is workable, however, and stress grades for timbers, developed along these lines, are incorporated in the practice of the American Society for Testing Materials,[†] the American Railway Engineering Association,[‡] and the American Association of State Highway Officials.[§]

Some progressive lumber manufacturers stamp upon their product its allowable fiber stress in bending or compression. A four-page digest[||] also has been published, by the National Lumber Manufacturers Association, of all current structural timber grades and the stresses at which their use is allowable.

Three other recent publications valuable to the wood user might well be mentioned:

One is a loose-leaf compilation known as "Wood Structural Design Data,"[¶] to which additions are made frequently, and which corresponds in its field of use to the handbook of the American Institute of Steel Construction.

The second is the "Wood Handbook,"[**] recently issued by the Forest Products Laboratory, containing a well-organized compilation of all the general knowledge about wood which is likely to be helpful to the wood-using industry.

The third is the "Lumber Grade-Use Guide,"[††] in which is given the grade of each commercial species recommended for each of the construction uses of wood.

SERVICE LIFE

In addition to strength grades definitely recognizable as such, there has come about during the last few years a much wider and more general distribution of the principal structural species. The use of all-heart timber of certain species, or of preservative treatment where conditions make this desirable, has greatly increased the service life of timber structures exposed to unfavorable conditions. Choice between timber and other materials has become a problem in economics, with first cost balanced against service life, maintenance, fixed charges, cost of painting, and other factors. One of the country's great railway systems, as a result of its experience over a long period, has recently assumed an average service life of fifty years for its timber structures. Since much of the experience represented by this estimate is based on early and more or less experimental preservatives and treatment practice, it may reasonably be assumed that as time goes on this average expectancy will be exceeded in other structures as well as in railway practice.

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[*] Government Printing Office, Washington, D. C. Price, 5 cents. 27 pp.

[†] Proceedings of Annual Meeting, Vol. 35, Part I, p. 364.

[‡] Report of Committee VII, "Wooden Bridges and Trestles," February, 1935.

[§] "Standard Specifications for Highway Bridges," 1935 edition.

[||] "Working Stresses for Structural Lumber and Timber," National Lumber Manufacturers Association, Washington, D. C.

[¶] National Lumber Manufacturers Association, Washington, D. C. $1.

[**] Government Printing Office, Washington, D. C. 25 cents.

[††] National Lumber Manufacturers Association, Washington, D. C. $1.50.

TIMBER CONNECTORS

The third interesting advance in structural use of timber is the substitution of timber connector joints for the bolted, spiked or notched joints characteristic of the older timber structures. Timber connectors were introduced to American practice in 1933, and promise to increase greatly the use of timber for roof trusses, towers, bridges and other framed structures.

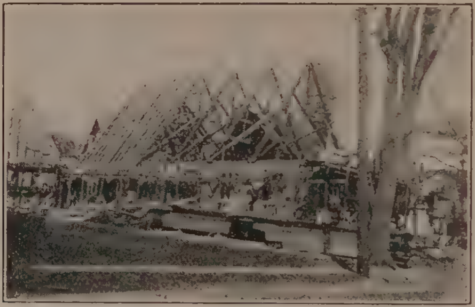


FIG. 1.—Timber-connector Roof Trusses of Ornamental Scissors Type for Church at Belmont, Massachusetts. Center Connections in these Trusses made with Torch-cut Steel Strips and Shear Plates

The designer of framed timber structures has always been hampered by the difficulty of securing strong enough connections with sections that otherwise served his purpose nicely. Loaded axially in tension or compression, wood is a fairly strong material. It will take more load per pound than steel, — if one can get hold of it to apply the load suitably. The bolted, spiked or notched joints characteristic of the older timber structures would develop only from one half to two thirds of the safe working strength of the members. The joint was from one half to two thirds as strong as the timber. Many a 6″ × 10″ truss chord has been used where a 6″ × 6″ would have taken the load, but would not provide net area at the bolt holes. Many a strut now in service should have been 4″ × 4″, but had to be made 4″ × 8″ to afford enough area in bearing perpendicular to the grain of the chord.

With timber connectors, and the changes in design practice they make feasible, joints can be secured which in most cases realize the full working strength of the members. There is little waste of footage, and the structural efficiency of the material is increased from 50 to 100 per cent. That is a very important increase. The importance of this fact can be appreciated as one might an announcement that structural steel has been made nearly twice as strong as it always has been.

It is possible in many cases to design timber connector roof trusses weighing no more than steel structures for the same loading and span. A pound of good timber does the same structural service as a pound of steel, and a board foot of timber has about the same structural usefulness as a square inch of steel a foot long.

An improvement of this magnitude in the usefulness of a framing material is a development of considerable importance to the building industry. Its full possibilities probably will not be realized for many years. Some idea of the probable effects can be had from a consideration of the use of connectors since their introduction in American practice about three years ago. Several million connectors have been used in that time in over 7,000 buildings and structures of all types, including among others farm and camp buildings, roof trusses and arches of all types up to 120-foot span, railway bridges and trestles, highway bridges up to 200-foot span; tank, lookout and radio towers; piers, wharves and hydro-electric work; in ice breakers and barges; in distillery barrel racks, — in practically every type of situation for which timber framing is suitable.

This has come about in spite of the fact that the manufacturers' facilities for advertising and publicizing connectors are rather limited. It has happened during a period in which the state of the building industry has been neither prosperous nor active. We may reasonably expect that with returning general activity in the building world timber connector construction will find steadily increasing use.

There are three types of timber connectors in commercial distribution in this country. Details of each type and the customary installation procedure are shown in the illustrations following. Constant improvement is being made in the technique of installation, leading to lower costs of fabrication and erection.

One of the problems in introducing timber connectors to American practice has been the lack of concerns prepared to act as fabricators for structural timber. Almost every city of any size has one or more steel fabricating concerns prepared to furnish steel work, cut to length and punched, riveted or welded ready for erection. With a few exceptions, the lumber industry has never had such a fabricating class between the producer and the builder, and reasonable quotations and dependable delivery on structural timber framing have not always been easy to get. The number of such concerns is increasing rapidly, however, and there should within a short time be keen competitive bidding on work of this sort, especially as the fabrication equipment required is relatively simple, portable and low in cost.

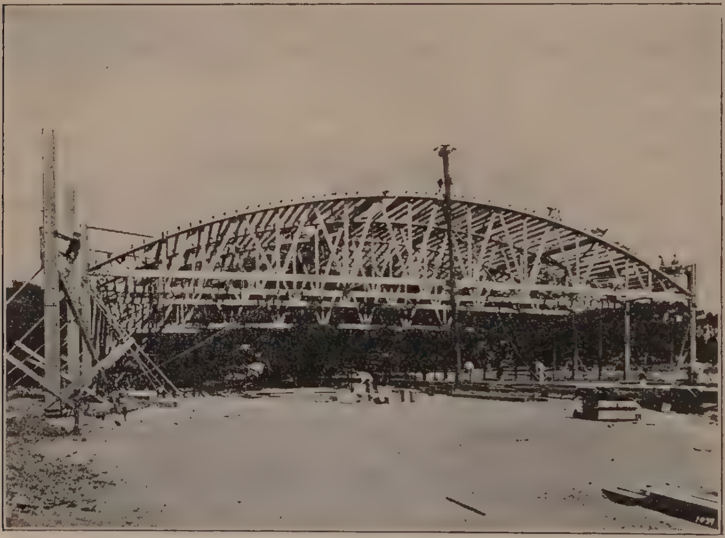


FIG. 2.—Bowstring Trusses in which Teco Toothed Rings were employed in Travel and Transportation Building, San Diego Exposition

It is quite feasible to fabricate members for timber connector structures from shop details in exactly the same fashion structural steel is fabricated, and to ship the members knock-down or partly shop-assembled to the site for erection. The Chesapeake & Ohio Railroad framed 70-foot roof trusses in this way, and put them in their treatment cylinders entirely assembled.

The 326-foot wood radio tower, recently built by Station WRVA at Richmond, Virginia, was entirely fabricated from shop details, although the work was actually done at the tower site. Numerous roof truss jobs, lookout towers and other structures have been shop-fabricated and shipped long distances for erection.

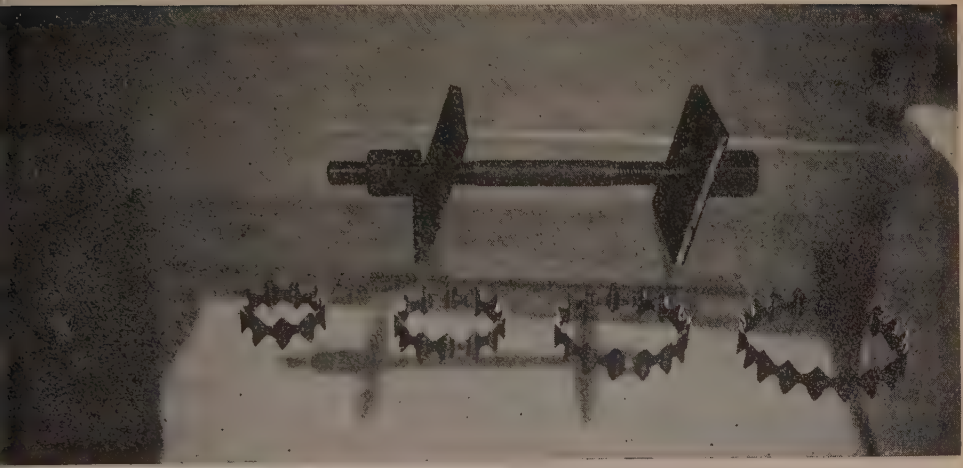
Forest Resources Conserved only through Use

It is quite usual for those who have not given the matter study to feel that forest resources should be conserved, and that the use of timber should be avoided whenever possible, as a sort of patriotic duty. Further reflection discloses that timber is a crop, not a mine. A virgin forest will not add materially to its stumpage if left untouched for a century. Young trees can grow only where old trees fall, due to insects, storm or decay. Trees must be cut before there is opportunity for trees to grow again.

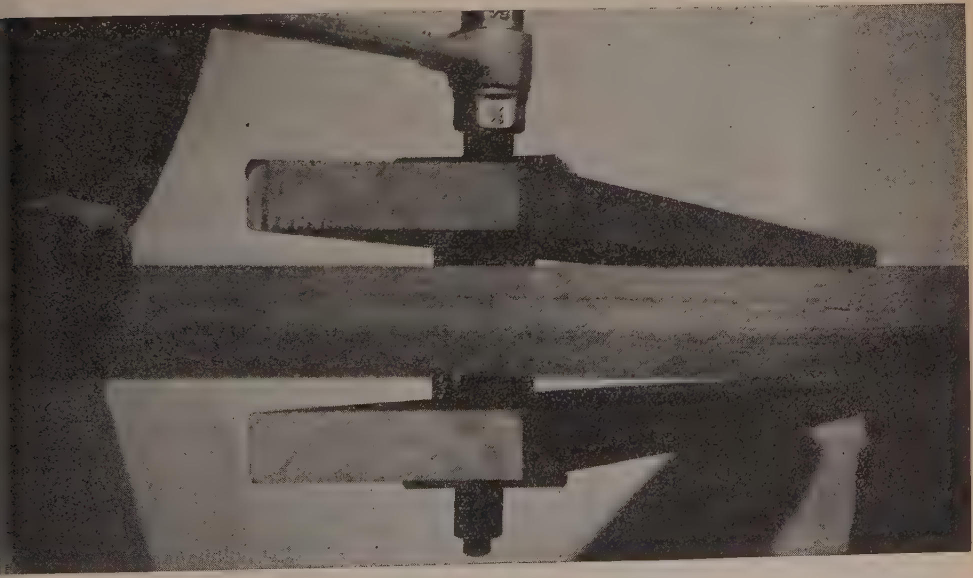
The chief and in some cases the only justification for systematic large scale reforestation, or even for selective cutting, is the expectation of a continuing market. Every move to discourage the use of wood is a move to discourage commercial reforestation. It requires a forward looking enterprise to plant or preserve a crop destined to be cut fifty or one hundred years hence, with all the contingencies of fire, taxation, expropriation or industrial change that may occur in the interim. The surprising thing is that such forest owners exist, and do plan for the future in spite of the unconsidered publicity one often sees discouraging the use of wood.

It is an interesting reflection that sunshine is the principal item of terrestrial income, and that the forest is our most effective equipment for turning this income into usable forms. An acre of forest land will turn more sunlight into cellulose than any other process. Whether we will be thinking and talking of structural timber a few years hence in the same way we do now is a question. Instead of sawed timbers we may be using some synthetic material into which the whole body of the tree is incorporated. We may be building our arched bridges of some plastic forest product instead of concrete. Just around the corner there may be a glue as effective as the lignin that now holds the wood cells together, and we shall make large timbers out of small strips by a continuous process, cutting them off in lengths as needed.

The possibilities are endless, and the laboratories are already at work on them. Whatever the results, it is reasonably sure that as time goes on forest products will receive increasing structural use. Shall we not hope, next time the choice of materials has to be made, that less time and thought will be given to enlarging on the disadvantages of wood and more to capitalizing its advantages.

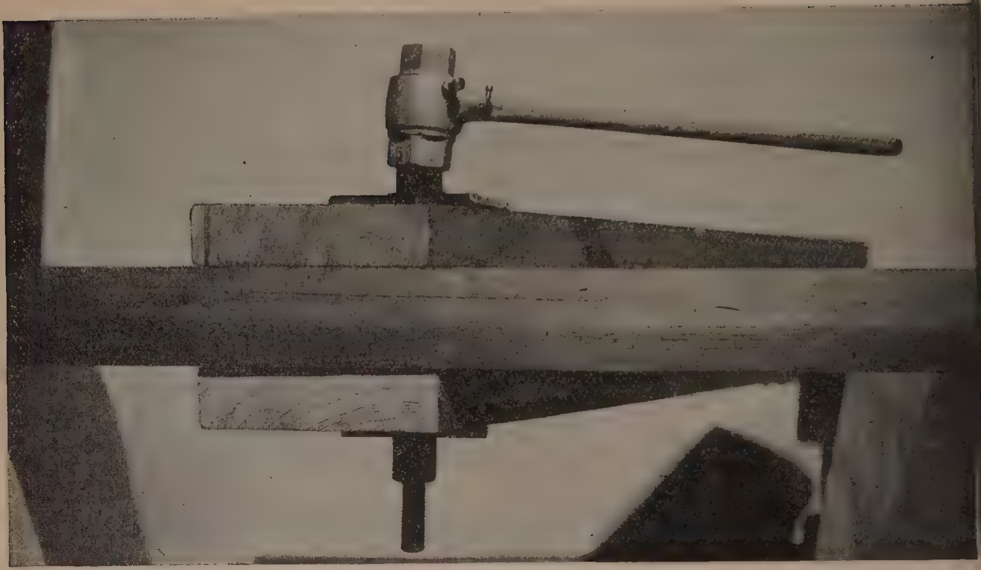


Toothed rings are sharp-toothed rings of sixteen-gage sheet steel. Four sizes shown above re commercially available: 2″, 2⅝″, 3⅜″, and 4″. Behind them in the photograph is a high rength nickel-steel bolt with double depth nuts and large washers for imbedding the toothed ngs.

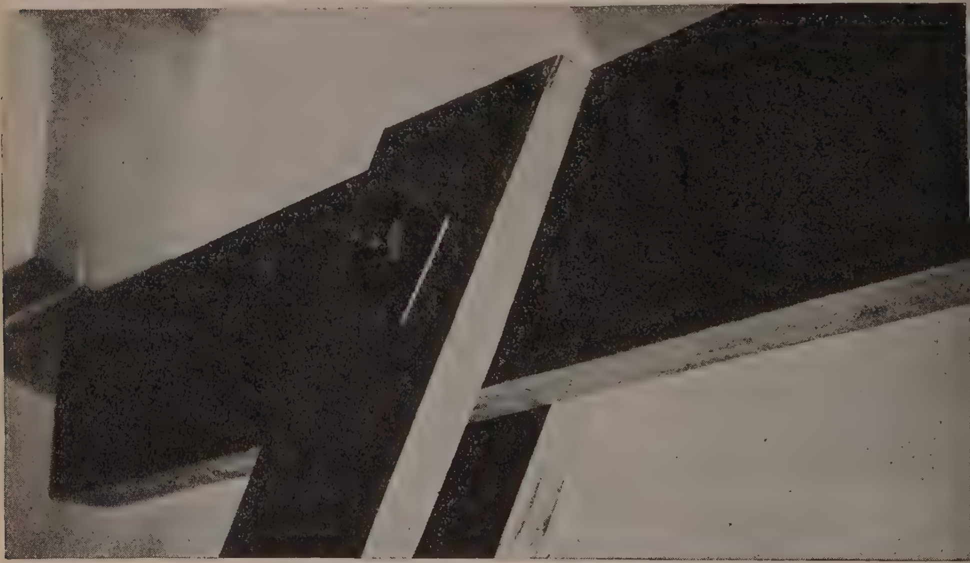


After holes are bored through the timbers, toothed rings are placed between them and lightly acked in place. Photograph above shows the imbedding of toothed rings with high strength steel olt and large washers (obtainable from the Timber Engineering Company). Long-handled atchet wrench is used instead of ordinary wrench to eliminate removal of wrench after each half evolution.

FIG. 3.—TOOTHED RING CONNECTORS

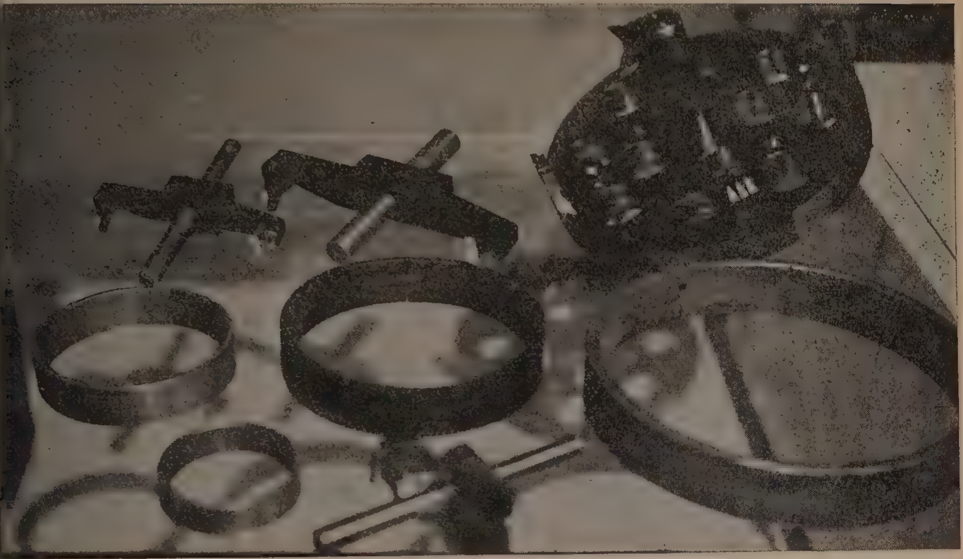


Joint drawn together with high strength bolt. Toothed rings completely imbedded and surfaces of timber in contact. High strength bolts and large washers are later replaced with ordinary machine bolts and square washers.

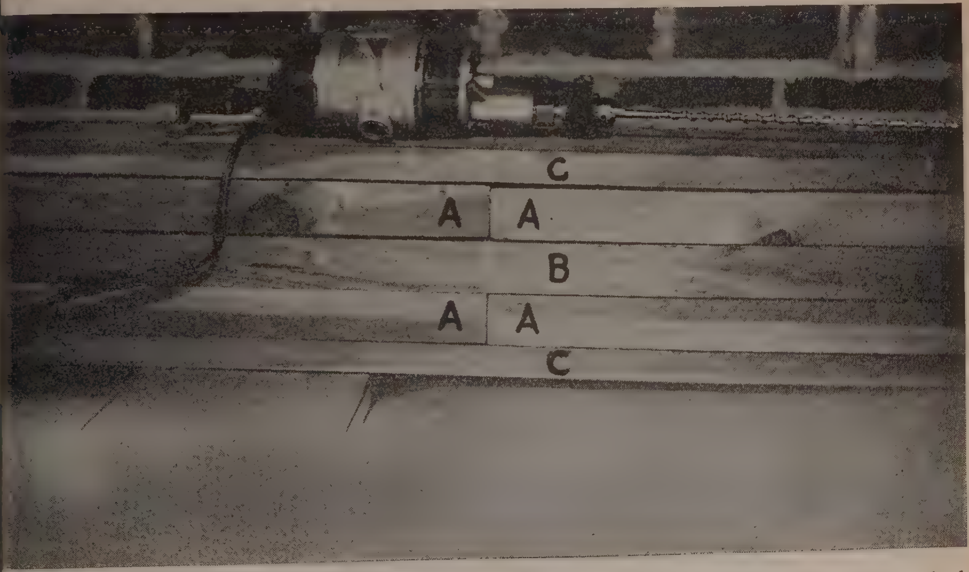


Completed joint showing 3″ × 3″ × ⅜″ washer, ordinarily used with 3⅜″ toothed rings.

FIG. 4. — TOOTHED RING CONNECTORS



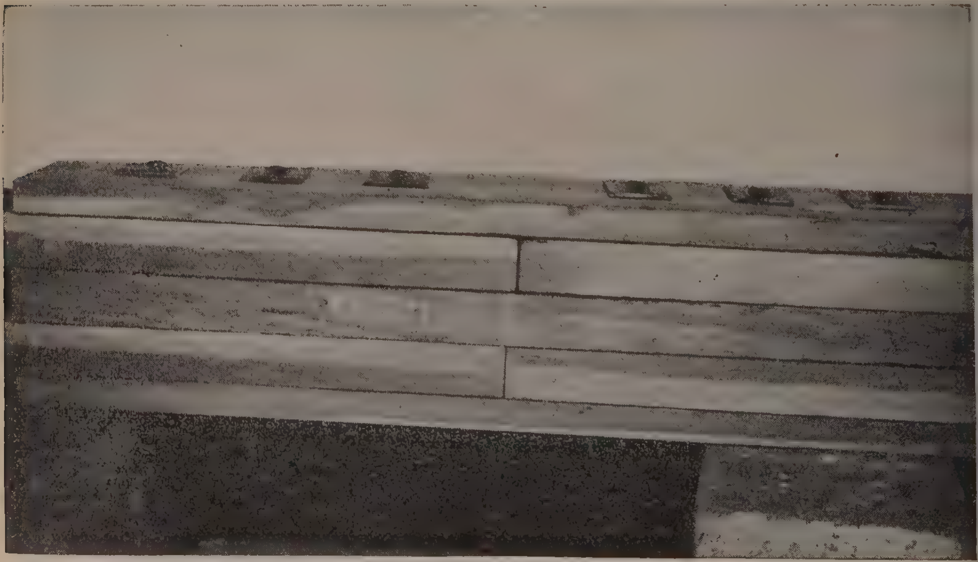
Split rings are plain steel rings of rectangular cross-section, with a tongued and grooved eak in the perimeter. Four sizes shown above are commercially available: 2½″, 4″, 6″ and ′. Photograph also shows grooving tools for each size.



Typical split ring spliced joint for a lower truss chord made up of two pieces 3″ × 8″, marked . Splice to be made with one 3″ × 8″ center piece, marked B, and two 2″ × 8″ side pieces, marked . Splice pieces are placed outside and between the chord pieces and the assembly lightly spiked gether before boring.

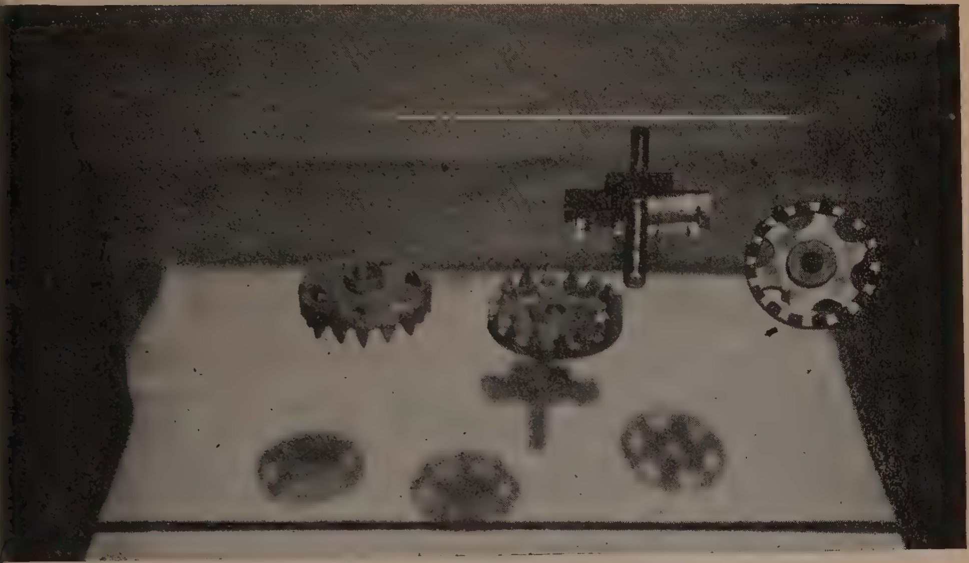
FIG. 5.—SPLIT RING CONNECTORS

After holes are bored the full thickness of the assembly, the pieces forming the assembly are laid apart and grooved with a 4″ grooving tool (obtainable from the Timber Engineering Company), as shown above.

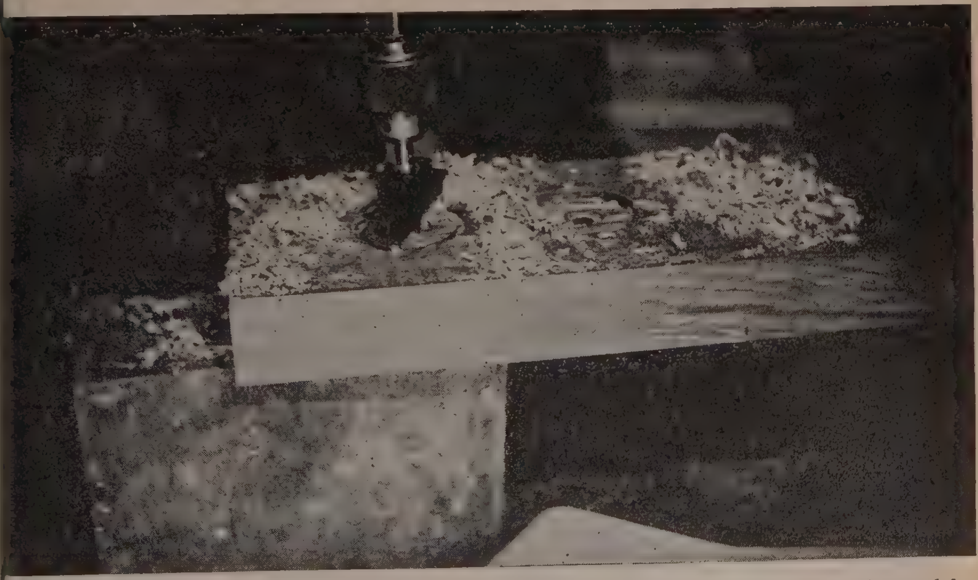


Completed splice. With six pairs of 4″ split rings on each side of the splice between the four contact surfaces provided, the joint has a capacity of 84,000 pounds in dense timber.

FIG. 6.— SPLIT RING CONNECTORS

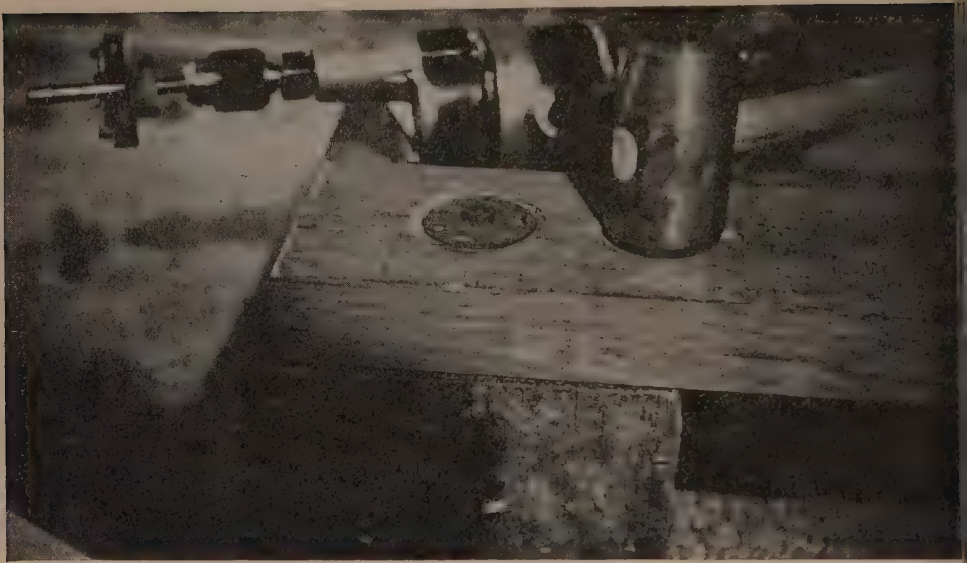


A shear plate is a malleable casting consisting of a circular plate with teeth arranged about he perimeter of one face, and a cylindrical hub on the opposite face. Photograph shows shear lates and tool used for cutting the daps in which they are imbedded.

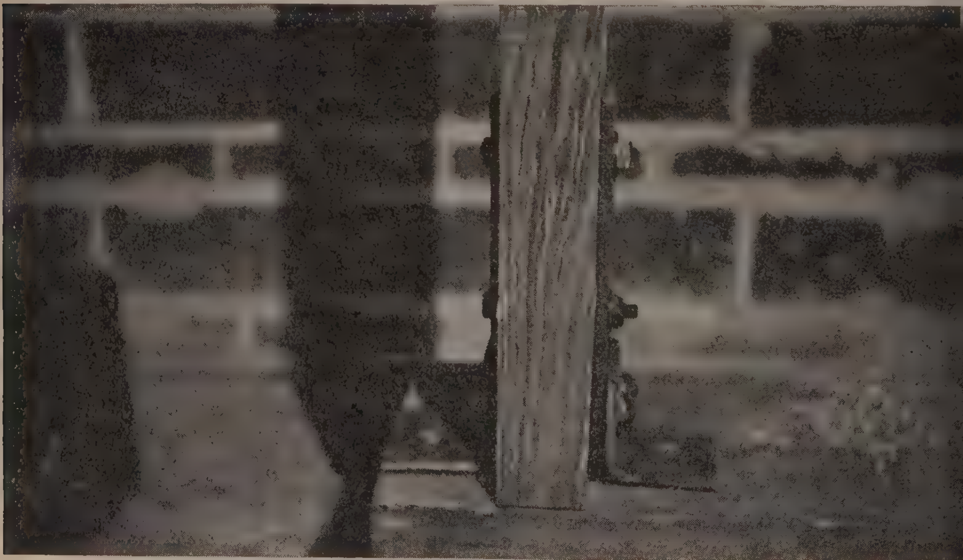


In marking the holes, the steel shapes with which connection is to be made may be used for emplate. Bolt holes (9/16″) should be bored from each face to meet at approximately the center f the timber. Photograph shows the cutting of the circular grooves or daps for shear plates with pecial cutting tool (obtainable from the Timber Engineering Company).

Fig. 7.—Shear Plate Connectors



A special sledge with recessed face is placed on top of shear plate which is then imbedded b striking this tool with an ordinary sledge. Shear plates are partly fitted and partly driven in th pre-cut grooves or daps. Photograph shows one shear plate already imbedded and one in proces of driving; grooving tool and motorized drill shown in background.



Completed column connection. Footing bolts fit in the holes shown in the horizontal legs o the connection angles.

Fig. 8.—Shear Plate Connectors

Discussion

STUART HUCKINS:* It is unfortunately true that lumber is not always as good as it might be. It is equally true that better lumber is available than is sometimes furnished. Not infrequently the fault lies with the specifications for the job. "Lumber shall be fir, spruce or yellow pine" is still a favorite specification for structural lumber. Since there are five structural grades of each species, and since there are great differences in their mechanical properties, such a specification is not susceptible of an intelligent interpretation, nor is it conducive to the delivery of high-grade material. Sometimes in recognition of the vagaries inherent in descriptions of this kind, a further qualification is added to the effect that the lumber shall be free from knots, sap and other imperfections which will materially affect its strength. This does not clarify the situation. Without sap trees would be imperfect things. Sap has nothing to do with strength; knots and other imperfections do materially affect the strength of wood. Such a specification, however, is inadequate, because it does not define the initial strength factors which it is desired materially not to affect.

I feel free to criticise specifications, because in doing so I place the blame largely upon my own industry, which, until recently, has failed generally to provide adequate information on which specifications may be intelligently predicated. Architects and engineers are concerned with hundreds of different materials. They cannot be expected to know all there is to know about each of these unless they are provided with authentic information. Moreover, there are changes in technology and in nomenclature of which they should be advised as these changes occur. With respect to lumber, the lumber industry should assume the responsibility of providing factual information, and be sure that it is widely disseminated and readily available.

Through extensive researches conducted by the Forest Products Laboratory at Madison, Wisconsin, a vast amount of data concerning wood as a structural material has been made available to, and is being used by, the regional associations of lumber manufacturers, whose current grading rules for structural timber are in conformity with the grading procedure developed by the Forest Products Laboratory and now presented in Miscellaneous Publication No. 185 of the United States Department of Agriculture. Structural lumber is now obtainable in grades which present definite minimum strength properties. These may be specified by their commercial designations or they may be specified in terms of their assignable working stresses.

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* Geo. McQueston Company, East Boston, Mass.

For the purpose of selecting proper structural lumber, *i.e.*, for load-bearing purposes, the following is suggested as a form for standard specification for lumber used structurally. With such qualifications as are later discussed, this appears to include the important conditions.

Suggested Form of Specification

Wood structural members shall be of such grade and species as to qualify under authoritative grading procedure for the following unit working stresses for continuously dry locations:

Lbs. per Sq. In.

Posts and columns:
- Compression parallel to grain . . . .
- Modulus of elasticity . . . .

Joist and plank:
- Fiber stress in bending . . . .
- Horizontal shear . . . .
- Compression perpendicular to grain . . . . . .
- Modulus of elasticity . . . .

Beams, girders, stringers:
- Fiber stress in bending . . . .
- Horizontal shear . . . .
- Compression perpendicular to grain . . . . . .
- Modulus of elasticity . . . .

Authority for the assignment of these stresses to the species and grades which the successful bidder purposes to furnish shall be submitted to the architect for approval prior to purchase of the material.

Species and grade furnished shall be evidenced by a grade-mark on each piece or by other authentication acceptable to the architect.

The working stresses to be filled in would be those used in the design. Consideration should be given, however, to factors other than those pertaining to strength, *i.e.*, appearance, durability, and resistance to mechanical wear. These elements may be covered by further provisions, as, for example, restriction as to species and/or heartwood content. If long leaf yellow pine is desired, the first sentence of the specification would read "Wood structural members shall be long leaf yellow pine of such grade as to qualify . . .", etc. If exceptional durability is desired, the specification should require: ". . . shall be long leaf yellow pine of 85 per cent heartwood by girth measure; otherwise of such grade . . .", etc. Similar modifications may easily be introduced without rendering the specification either cumbersome or obscure, or affecting its essential simplicity.

The working stresses should, of course, lie between the upper and lower limits assignable to commercially available grades and species.

The form of specification suggested is not as yet dignified by official approval of any kind. Its recommendations are brevity, clarity, standardization, and the fact that it places emphasis where it belongs — on strength. If it were used, it would probably cause miscellaneous consternation. Nevertheless, it is hoped that somebody will try it some time.

OF GENERAL INTEREST

BRONZE TABLET PLACED ON PUBLIC GARDEN FOOT BRIDGE IN HONOR OF DESIGNERS — CLEMENS HERSCHEL AND W. G. PRESTON

The Boston Society of Civil Engineers has recently sponsored the placing of a bronze tablet on the foot bridge which for nearly seventy years has spanned the pond in the Public Garden at Boston. This tablet, shown in an accompanying photograph, commemorates the designers of this unique structure, — Clemens Herschel, Civil Engineer, and William G. Preston, Architect. The recognition of these two eminent men of an earlier generation has been made possible through the generosity of Winslow H. Herschel and Mrs. Hobart Rawson, son and daughter of the late Clemens Herschel, a past president and honorary member of our Society.

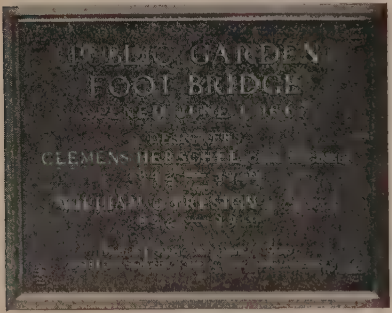


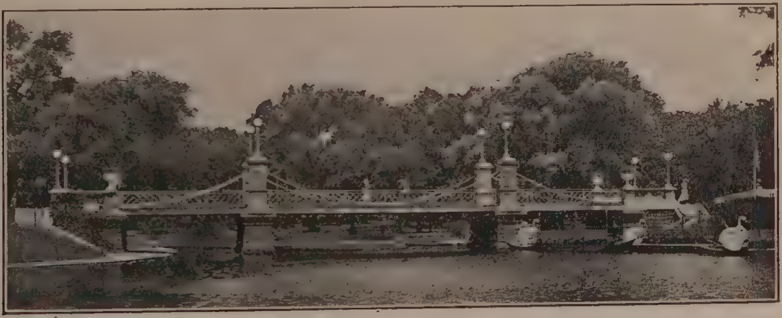
FIG. 1. — MEMORIAL TABLET

Countless thousands have walked across this bridge and many have glided under it in Boston's celebrated "swan boats." Few of Boston's inhabitants, however, have known of its history. Built originally as an eye-bar chain suspension bridge, subsequent changes in the floor system have served to modify the structure so that it no longer functions on the suspension principle. Despite these structural changes, this bridge, with its unusual setting, will always be a feature of interest to all those who take pride in Boston's Public Garden.

The following excerpt from the city of Boston's Auditor's report (1867–68) tells of the competition for a design of a foot bridge which would best fit the conditions, and of the award to Clemens Herschel, then a young engineer of Boston who later was one of the most noted civil engineers in the country, and to William G. Preston, also a young man, who became one of Boston's most prominent architects:

> In the original plan for laying out the Public Garden, it was intended that there should be a bridge over the pond on line of Commonwealth Avenue, and then to continue that thoroughfare through the garden to Charles Street and across the Common, at least for pedestrians. In accordance with this intention, the City Council appointed a joint special committee, spring of '66, on the subject, who advertised, May 2, "for plans and estimates for the construction of a bridge of wood, iron, or stone." In answer to this somewhat open and indefinite request, some fifteen or more designs were presented, all differing from each other. . . . To come to a decision, the Committee decided that the bridge should be up high

enough to allow skaters to pass under, that the paths along the edges of the pond should not be closed up, that the bridge should be of iron and stone, and finally cost as little as possible, though fulfilling the above conditions. The plan built from was the one that came up to the above-mentioned requirements at the least cost, and was, therefore, adopted. To have made the bridge in one span over the pond would have made a lighter looking (though not an actually lighter) and a handsomer bridge; but, the other conditions remaining the same, it would have cost more than the City Government was willing to expend. . . . The bridge is one hundred feet long and fifteen feet wide (it was designed to be ten feet wide, but this the Committee changed), and is a chain suspension bridge, the piers and abutments being of Quincy and Concord granite. It was opened Saturday, June 1, '67, and by actual count and calculation it was estimated that more than twenty thousand people passed over the next day. Fully that number use it now on any pleasant holiday, while the ordinary daily travel over the same from and to the West End is in itself large enough to demonstrate the utility of building it. The bridge was designed and its construction superintended by Clemens Herschel, Civil Engineer, and William G. Preston, Architect. Cost of the bridge, including the steps and grading of the approaches to the same, $19,000.



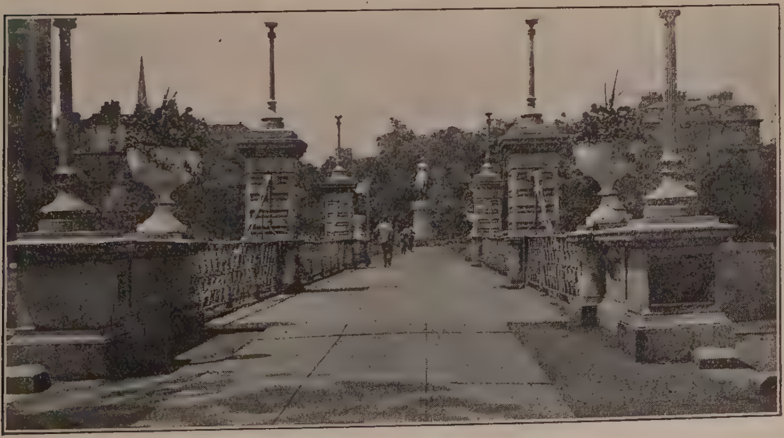


FIG. 2. — PUBLIC GARDEN FOOT BRIDGE

Boston Society of Civil Engineers and International Conference on Soil Mechanics and Foundation Engineering — Excursion to Ware and Swift River Water Supply Projects.

A joint excursion was made on Friday, June 26, 1936, to the Ware and Swift River projects of the Metropolitan District Water Supply Commission by the Boston Society of Civil Engineers and members of the International Conference on Soil Mechanics and Foundation Engineering (which was being held at Harvard University). About one hundred and twenty-five persons made up the party, including engineers and scientists from sixteen different countries. The trip was made in four busses, leaving the Harvard Union, Cambridge, at 8 A.M., and a strict time schedule was adhered to in order to complete the trip, one hundred and seventy-five miles, within the time allowed. A buffet lunch was served by the Dutchland Farms at noon at the Quabbin Reservoir Division Office, Enfield.

The points of interest on the outward trip included — the Cochituate and Sudbury Reservoir systems, the earlier reservoirs built for supplying Boston. Points of interest on the new Quabbin Reservoir included the Quabbin Park Cemetery, the main dam at Enfield, where rolled embankment is now being placed subsequent to the completion of the caisson core wall. The route followed the present highways for several miles, passing through several villages located within the future reservoir limits, and these will be submerged by many feet of water upon completion of the dams. The embankment at the dike is being placed by the method of hydraulic sluicing. The return trip included the Quabbin Aqueduct tunnel intake and the intake works at the Ware River.

The evening program included a dinner at the famous Wayside Inn at Sudbury. About two hundred persons attended this affair, including the ladies, and all were afforded an opportunity to see the many historical antiques which have been assembled under the direction of Henry Ford.

Following the dinner, at which Mr. Frank E. Winsor, Chief Engineer, Metropolitan District Water Supply Commission, acted as toastmaster, addresses were given by Mr. F. E. Schmitt, Editor of "Engineering-News Record," and by Dr. Karl Terzaghi of the Technische Hochschule, Vienna, Austria, visiting lecturer at Harvard University, and President of the Conference.

The following members of the Conference on Soil Mechanics and Foundation Engineering, and also members of the Boston Society of Civil Engineers, attended the excursion:

Austria: Prof. Dr. Karl von Terzaghi, Oberstadtbaurat Dr. Rudolf Tillman.

Belgium: Dr. Paul-E. Raes.

Canada: Mr. Robert F. Legget, Mr. J. W. Lucas, Mr. R. J. Mattson.

Denmark: Mr. Aage E. Bretting.

Egypt: Dr. W. S. Hanna, Dipl. Ing. Gregory Tschebotareff.

England: Mr. L. F. Cooling.

France: Dr. Curt Kollbrunner, Ing. K. Langer.

Germany: Prof. Dr. Arnold Agatz, Dr. Ing. Leo Casagrande, Regierungs- und Baurat Joachim Ehrenberg, Dr. Ing. Lutz Erlenbach, Dipl. Ing. Ernst von Gottstein, Prof. Dr. Ing. Franz Kögler, Dr. Ing. habil Wilhelm Loos, Dr. Ing. Otto Syffert.

Italy: Ing. Giovanni Rodio, Dr. Ing. Christian Veder.

Mexico: Ing. Fernando Amor, Arquitecto Bernardo Calderon, Ing. Nabor Carrillo, Luis Flores Covarrubias, Ing. Jose Antonio Cuevas, Ing. Francisco Gomez-Perez, Ing. Federico Ramos, Ing. Luis Rivero del Val, Ing. Jose Vazquez-del-Mercado.

Netherlands Indies: ir. O. Stevens.

Poland: Ing. Radzimir Pietkowski.

South Africa: Mr. Gerald Hall.

Straits Settlements: Mr. J. J. Bryan.

Switzerland: Mr. Alfred Renaud.

United States: Mr. A. H. Baker, Prof. E. E. Bauer, Mr. E. F. Bennett, Mr. Theodore L. Bristol, Prof. Kirk Bryan, Mr. S. J. Buchanan, Mr. D. M. Burmister, Mr. Walter N. Cargill, Mr. W. B. Carr, Prof. Arthur Casagrande, Prof. F. J. Converse, Mr. J. S. Crandall, Mr. A. E. Cummings, Mr. F. T. Darrow, Mr. R. F. Dawson, Mr. S. M. Dore, Prof. W. S. Downs, Mr. O. R. Egge, Mr. H. Ensz, Mr. R. C. Falconer, Mr. H. A. Fidler, Mr. J. W. Greenleaf, Mr. F. F. Hampe, Mr. J. P. Hartmann, Mr. L. F. Harza, Mr. G. A. Hathaway, Mr. Kjetil Haugeto, Mr. Robert Hennes, Mr. H. M. Hill, Mr. W. S. Housel, Mr. H. S. Hunt, Mr. Everett N. Hutchins, Mr. H. T. Immerman, Prof. H. T. Jenkins, Mr. J. E. B. Jennings, Mr. L. H. Johnson, Jr., Prof. Lewis J. Johnson, Mr. A. L. Jorissen, Mr. R. P. Joslyn, Mr. J. D. Justin, Mr. K. R. Kennison, Mr. E. J. Kilcawley, Prof. W. P. Kimball, Mr. T. T. Knappen, Prof. D. P. Krynine, Mr. O. B. Lane, Mr. W. H. Leavitt, Mr. Earl M. Major, Mr. A. B. Mason, Mr. T. A. Middlebrooks, Mr. I. F. Morrison, Mr. J. O. Morton, Mr. J. R. Nichols, Mr. J. O. Osterberg, Mr. George Paaswell, Prof. B. H. Petty, Prof. L. F. Rader, Prof. J. L. Rosenholtz, Mr. O. N. Rove, Mr. H. E. Russel, Mr. P. C. Rutledge, Mr. F. E. Schmitt, Mr. T. M. Shaw, Mr. F. B. Slichter, Mr. Bayard F. Snow, Mr. L. K. Tan, Mr. D. W. Taylor, Mr. P. E. Taylor, Mr. R. A. Trufant, Prof. LeRoy Tucker, Mr. E. W. Vaughan, Mr. Lazarus White, Prof. G. M. Williams, Mr. W. R. Wilson, Mr. Frank E. Winsor, Prof. E. R. Wiseman.

The detail plans for the excursion were made under the direction of Mr. Karl R. Kennison, Assistant Chief Engineer, Metropolitan District Water Supply Commission; Prof. Arthur Casagrande, Harvard Graduate School of Engineering, Chairman of the Conference Committee; Prof. Albert Haertlein and Mr. Philip C. Rutledge, also of Harvard University; and Everett N. Hutchins, Secretary.

Boston Society of Civil Engineers Scholarship in Memory of Desmond FitzGerald awarded to James L. Dallas, Student at Northeastern University.

James L. Dallas of Beverly, Mass., a senior student in civil engineering in the School of Engineering at Northeastern University, was awarded the Desmond FitzGerald Scholarship of the Boston Society of Civil Engineers on April 22, 1936. The presentation of the Scholarship of $100 was made at a meeting of the students of the school at Jordan Hall by Prof. H. K. Barrows, President of the Boston Society of Civil Engineers.

PROCEEDINGS OF THE SOCIETY

MINUTES OF MEETINGS

Boston Society of Civil Engineers

April 15, 1936. — A regular meeting of the Boston Society of Civil Engineers was held this evening at the Engineers Club, and was called to order by the President, H. K. Barrows. Two hundred and ten members and guests were present. One hundred and eleven attended the buffet supper.

President H. K. Barrows introduced the speakers of the evening, who presented a symposium on "The March, 1936, Flood." The speakers included H. B. Kinnison, District Engineer, Water Resources Branch, Boston, United States Geological Survey; Arthur T. Safford, Chief Engineer, Proprietors of Locks and Canals on Merrimack River, Lowell, Mass.; S. Stanley Kent, Assistant Engineer, Proprietors of Locks and Canals on Merrimack River, Lowell; Richard S. Holmgren, Chief Engineer, New Hampshire Water Resources Board, Concord, N. H.; Harry N. Nelson, Hydraulic Engineer, New England Power Engineering and Service Corporation, Boston; A. W. Ladd, Hydraulic Engineer, Holyoke Water Power Company, Holyoke, Mass.

The talks were well illustrated by lantern slides and motion pictures.

The meeting adjourned at 10 P.M.

Everett N. Hutchins, *Secretary.*

May 20, 1936. — A regular meeting of the Boston Society of Civil Engineers was held this evening at the Engineers Club and was called to order by the President, H. K. Barrows. Eighty-seven members and guests were present. Sixty-six attended the buffet supper.

The President announced the deaths of the following members: John C. Chase, who had been a member since December 20, 1893, and died April 15, 1936; Lewis M. Hastings, who had been a member since March 15, 1882, and died April 25, 1936; and Frank O. Whitney, who had been a member since January 15, 1879, and died May 13, 1936.

The President then introduced Dr. Karl Terzaghi, who gave an address on "A Fundamental Fallacy in Earth Pressure Computations." Dr. Terzaghi explained the reason why the classical earth pressure theories contradict the experiences of contractors concerning the distribution of earth pressure on timbering in cuts. By combining Coulomb's earth pressure theory with the results of recent experimental investigations Dr. Terzaghi succeeded in eliminating the existing contradictions between theory and practice, and to arrive at conclusions of considerable practical importance. Dr. Terzaghi's paper was printed in full in advance of this meeting in the April, 1936, Journal. The talk was illustrated by lantern slides.

Following the talk, discussion and comments were made by Mr. Lazarus White, President of Spencer, White and Prentice, Inc., of New York; Mr. Donald W. Taylor, Soil Mechanics Laboratory, Massachusetts Institute of Technology; Mr. William E. Bassett, New England Power Engineering and Service Corporation, Boston; and Prof. Arthur Casagrande, Professor of Soil Mechanics, Harvard Graduate School of Engineering.

The meeting adjourned at 8.45 P.M.

Everett N. Hutchins, *Secretary.*

Sanitary Section

April 1, 1936. — A special meeting of the Sanitary Section of the Boston Society of Civil Engineers was held April 1, 1936. Preceding the meeting, twenty-three members gathered at Patten's Restaurant, Court Street, for dinner.

The meeting was called to order by Chairman Paul F. Howard at 6.45 P.M., in the Society rooms, with forty-three members present.

Almon L. Fales, of the firm of Metcalf & Eddy, presented a paper on the "Chemical Precipitation of Sewage and Industrial Wastes." Mr. Fales explained the various methods used and outlined the operation of several plants being operated both in this country and abroad. An interesting discussion followed.

The meeting adjourned at 8.30 P.M.

RALPH M. SOULE, *Clerk*.

Designers Section

APRIL 8, 1936. — A meeting of the Designers Section was held at the Society rooms April 8, 1936, at 6.45 P.M.

The minutes of the annual meeting held in March were read and approved.

Chairman Haertlein then introduced the speaker, Dr. William F. Clapp, consulting biologist, whose subject was "Marine Borer Problems."

Dr. Clapp's talk was illustrated with lantern slides, and described the anatomy, habits and activities of various marine borers, particularly *teredo navalis* and *limnoria*. A discussion period followed the talk during which Dr. Clapp commented on various methods of protection against the borers.

The meeting adjourned at 8.40 P.M. with an attendance of sixty.

ANTHONY S. COOMBS, *Clerk*.

Northeastern University Section

MARCH 10, 1936. — The Northeastern University Section of the Boston Society of Civil Engineers held a regular meeting in Room 201L, Laboratory Building, on March 10, 1936.

Vice-Chairman G. Albion Smith called the meeting to order at 12 o'clock, noon. A committee consisting of Messrs. Hanna, Sweeney and Baglione was appointed to serve as a Nominating Committee to nominate men to be elected for the various offices of the Section for the year 1937. The election will be held at the next regular meeting.

Mr. Smith then introduced the speaker of the day, Mr. H. W. Eldredge, Technical Service Engineer for Universal Atlas Cement Company. Mr. Eldredge presented a very interesting talk on the manufacture of cement.

There were seventy-five members and guests present.

The meeting adjourned at 1.30 P.M.

LESTER S. PERRY, *Vice-Clerk*.

MAY 19, 1936. — The Northeastern University Section of the Boston Society of Civil Engineers held a regular meeting in Room 201L, Laboratory Building, on May 19, 1936.

The Vice-Chairman called the meeting to order at 12 o'clock noon. The names of the men nominated by the Committee appointed at the previous meeting were presented and voted upon, the following being elected:

Chairman — G. L. Cheney.
Vice-Chairman — L. S. Perry.
Clerk — R. W. Smith.
Vice-Clerk — R. C. Sanderson.
Executive Committee — L. W. Lenfest, G. Sorenson, E. H. Ziegler, C. Megann.

Vice-Chairman Smith then introduced the speaker of the day, Dr. Gail P. Edwards, Laboratory Co-ordinator, Massachusetts Department of Public Health. Dr. Edwards presented a very interesting talk on "The Sanitary Conditions of Boston Harbor."

There were about seventy-five members and guests present.

The meeting adjourned at 1.45 P.M.

LESTER S. PERRY, *Vice-Clerk*.

APPLICATIONS FOR MEMBERSHIP

[July 15, 1936]

THE By-Laws provide that the Board of Government shall consider applications for membership with reference to the eligibility of each candidate for admission and shall determine the proper grade of membership to which he is entitled.

The Board must depend largely upon the members of the Society for the information which will enable it to arrive at a just conclusion. Every member is therefore urged to communicate promptly any facts in relation to the personal character or professional reputation and experience of the candidates which will assist the Board in its consideration. Communications relating to applicants are considered by the Board as strictly confidential.

The fact that applicants give the names of certain members as reference does not necessarily mean that such members endorse the candidate.

The Board of Government will not consider applications until the expiration of fifteen (15) days from the date given.

For Admission

JACOBY, ERNEST, Brookline, Mass. (Age 25, b. Boston, Mass.) Was graduated with degree of B.S. in civil engineering at Harvard in 1932; March 28 to December 1, 1934, engineer and assistant to secretary of Massachusetts Emergency Public Works Commission; engineer with Howard M. Turner, October 23, 1935, to date. Refers to *H. G. Dresser, S. M. Ellsworth, A. Haertlein, H. M. Turner.*

JENNINGS, JEREMIAH E. B., Cambridge, Mass. (Age 24, b. Johannesburg, South Africa.) Was graduated from Witwatersrand University, Johannesburg, in 1934, in civil engineering and was junior lecturer at University for a year; assistant engineer with South Africa Irrigation Department for eight months; practical work in fitting shop and on construction while at University (required by course during long vacation) nine months; now completing a postgraduate course at Massachusetts Institute of Technology for M.S. in civil engineering. Refers to *J. B. Babcock, 3d, H. K. Barrows, W. M. Fife, G. Gilboy.*

TOMASELLO, SAMUEL J., Boston, Mass. (Age 45, b. Messina, Italy.) Was graduated from Boston English High School. On construction work, principally public works, about twenty years; in contracting business for himself, building roads, sewers, conduits, and other types of public works for the past sixteen years; now, in addition to other construction work, specializing in asphalt paving; President and Treasurer of Samuel J. Tomasello Corporation. Refers to *C. J. Carven, H. R. Chubbuck, A. E. Haskell, E. T. Hoisington.*

For Transfer from Grade of Student to Grade of Member

CARLSON, HARRY ALBIN, Lynn, Mass. (Age 25, b. Lynn, Mass.) Was graduated from Northeastern University with degree of B.S. in civil engineering in 1935. Cooperative work: 1931, with Shay & Shay, Lynn, as transitman, rodman and draftsman; 1933, with Hussey Manufacturing Company, North Berwick, Me., building two grandstands at St. John's Preparatory School, Danvers, Mass. Now with Lynn Planning Board as draftsman on Lynn Water Front Survey Project. Refers to *H. B. Alvord, C. O. Baird, J. N. DeSerio, A. E. Everett, Jr.*

CATTLEY, HENRY ROBERT, Melrose, Mass. (Age 24, b. Swampscott, Mass.) Attended Washington Grammar School 1926; was graduated from Melrose High School 1930 and Northeastern University 1935; during 1935 with John P. Rand, Civil Engineer and Surveyor, Melrose, Mass., as transitman for a year on E. R. A. projects in Melrose; on transfer to W. P. A., appointed senior engineer; supervise field work, design and write up projects; laid out second nine holes on Memorial Golf Course at Mt. Hood; made land court survey of 300 acres; contour plan 40-scale of whole area, batter boards for all construction work; designed concrete slabs for roof of garage, beams for club house and garage; built two miles of road and solved miles of drainage problems. Now senior engineer on all projects in Melrose on the W. P. A. Refers to *L. M. Allen, Jr., H. B. Alvord, A. W. Benoit, A. E. Everett, Jr., G. F. Hollinshead, Jr.*

For Transfer from Student

DUTRA, FRANCIS H., Middletown, R. I. (Age 25, b. Middletown, R. I.) Was graduated from Northeastern University June, 1935, with degree B.S. in civil engineering; employed by Naval Training Station, Newport, R. I., as chief of party in shoreline location survey of government reservations from November, 1935, to April, 1936; since April, 1936, with State of Rhode Island, in Department of Public Works, Division of Roads and Bridges, as material inspector. Refers to *H. B. Alvord, C. O. Baird, Jr., J. M. Dearborn, C. S. Ell, A. E. Everett, Jr.*

Hallett, Kenneth Tremere, Wellesley Hills, Mass. (Age 24, b. Dorchester, Mass.) Graduated from Northeastern University in June, 1936, with degree of B.S. in civil engineering; while at Northeastern University, employed by Stewart A. Cassidy, Wellesley town engineer, during July and August, 1935, and by Everett M. Brooks, civil engineer, Newtonville, Mass., from July 20 to August 15, 1935; by Aspinwall & Lincoln, Boston, from April 1 to 20 and May 10 to June 13, on United States Government, Old Harbor Village Housing Project, South Boston. Refers to *H. B. Alvord, C. O. Baird, C. S. Ell, A. E. Everett, Jr.*

Willard, Alan K., Nashua, N. H. (Age 23, b. Groton, Mass.) Was graduated from Northeastern University, 1935, with degree of B.S.; June, 1935, to February, 1936, with Nottingham, Surveyors, Hudson, N. H., as surveyor; February, 1936, to date, under engineering aide, Tennessee Valley Authority, Engineering Service Division, Lenoir City, Tenn. Refers to *H. B. Alvord, C. O. Baird, C. S. Ell, A. E. Everett, Jr.*

ADDITIONS

Members

Martin J. Cullity, 21 Newport Street, Arlington, Mass.
Adin M. Custance, 4 Shawmut Avenue, Hudson, Mass.
Mitchell W. Gawlowicz, 59½ Bullard Street, New Bedford, Mass.
David S. Geer, 45 Garden Street, Boston, Mass.
Albert A. Kenney, 54 Colburn Road, Wellesley, Mass.
Francis R. MacLeay, 33 West 42d Street, New York, N. Y.
John M. Ryan, 4 Wise Street, Jamaica Plain, Mass.
James H. Walsh, Jr., 90 Colborne Road, Brighton, Mass.
William C. Whiting, West Hanover, Mass.

Juniors

William R. Bauer, 24 Bellevue Street, New Bedford, Mass.
Howard W. Davis, 298 Essex Street, Lynn, Mass.
Joseph M. Dearborn, 407 Huntington Avenue, Boston, Mass.
Francis R. Dittami, 134 Jerome Street, West Medford, Mass.
Richard L. Dunning, 157 Main Street, Greenwich, N. Y.
George F. Hollinshead, Jr., 4 Hudson Street, Quincy, Mass.
Charles M. Kelley, 42 Crest Avenue, Revere, Mass.
Irving W. Kendall, 200 Pleasant Street, Stoughton, Mass.
Kenneth F. Knowlton, 11 Roxbury Avenue, Natick, Mass.
I. Robert Travers, 126 Devon Street, Roxbury, Mass.

Students

Edward M. Fucik, 43 Wendell Street, Cambridge, Mass.
James B. Gibbs, 22 Greenwich Park, Boston, Mass.
Kenneth T. Hallett, 12 Grantland Road, Wellesley Hills, Mass.
Edward T. Hurley, 2 Willis Street, Dorchester, Mass.
Orland T. Prichard, 60 Columbia Road, Portland, Maine.
Joseph Sorrenti, 47 Waverly Street, Everett, Mass.
Frank L. Soule, 32 Wachusett Road, North Weymouth, Mass.
John A. Sweeney, 85 Gainsborough Street, Boston, Mass.

DEATHS

John C. Chase	April 15, 1936
Lewis M. Hastings	April 25, 1936
Frank B. Rowell	May 31, 1936
Frank O. Whitney	May 13, 1936
Edward H. Kitfield	June 26, 1936
Frank S. Hart	July 11, 1936

BOOK REVIEW*

"American Sewerage Practice: Volume III, Disposal of Sewage." Third Edition, 1935. By Metcalf & Eddy. McGraw-Hill Book Company, New York. 892 pp. Price $7.

The three volumes of this work, first published in 1915, comprise the best treatise available on the subject of sewerage and sewage disposal. Volume I, dealing with the design of sewers, was revised in 1928. Volume II deals with construction methods. Volume III, dealing with the disposal of sewage, is now available in a revised edition. The high standard set in the original edition is maintained, and many of the chapters have been completely rewritten to bring the volume up to date. The authors have given freely from a wealth of experience gained from a long and extensive practice as consulting engineers in the field of sanitary engineering. The revised edition is authoritative and conservative.

The first six chapters deal with the historical development of sewage disposal, a general discussion of the methods in current use and their applicability, the characteristics of sewage and methods of analysis of sewage and sewage sludge. The space allotted in the first edition to the biology of sewage has been much reduced in the revision. The treatment of the methods of analysis and the decomposition of organic matter has been brought up to date with the proper emphasis upon the dissolved oxygen requirements. The many valuable data upon the composition of actual sewages in America and Europe which were presented in the first edition have been replaced by more recent analyses of American sewages. Most of these analyses include the five-day biological oxygen demand, which was not included in the analyses given in the first edition.

The material in Chapters VII and VIII, on pollution and self-purification of waters and on disposal by dilution, is largely new. The theory upon deoxygenation and reaeration as developed by the workers of the United States Public Health Service in the investigations of the Ohio and Illinois Rivers is concisely presented.

Chapter IX deals with sewage farms. Chapter X deals with the design of racks and screens and the disposal of screenings. The reader is left in doubt as to the best practice in determining rack area, no mention being made of the proper velocities to be used in rack chambers.

Chapter XI deals with grit chambers, skimming tanks and storm-water tanks. The chapter is completely rewritten in the light of more recent practice. The recent important developments in the use of skimming tanks for the removal of grease and in the use of storm-water tanks are briefly discussed.

In Chapter XII dealing with plain sedimentation, Hazen's theory of sedimentation is described more at length than in the original volume. Both surface area and detention period are submitted as important factors in design. A graph of suspended solids plotted against detention period for thirty-six different cases, including some chemical precipitation tanks, which was given considerable prominence in the first edition, is revised to eliminate chemical precipitation and repeated with less emphasis. The plotted points on this graph represent tests from both plain sedimentation and Imhoff tanks having different characteristics in fifteen different communities. Curves have been drawn in an effort to average the plotted points and to indicate trends in removal. Another graph showing removal against detention period from a single plant is more reliable and informative. The methods of design of inlets and outlets to secure uniformity of distribution to the settling tanks and to reduce short-circuiting are treated incompletely.

The material in Chapter XIII, dealing with chemical precipitation, has been completely rewritten to take account of the recent revival of interest and the newer developments in this method of sewage treatment. A number of the newer proprietary processes are described, but some of these processes are being superseded. The basic principles of chemical precipitation, or coagulation, are briefly but well stated.

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* By Thomas R. Camp, Associate Professor of Sanitary Engineering, Massachusetts Institute of Technology, Cambridge, Mass.

Chapters XIV to XVII, inclusive, cover the principles of sludge digestion as developed by numerous experimenters during the past decade, together with the methods of design of septic tanks, Imhoff tanks and separate digestors. These pages are well written and authoritative.

The treatment of intermittent sand filters is much the same as in the original edition, but has been condensed, as is also the case with the chapter on contact beds. A new chapter on contact aerators is concise but informative.

The material on trickling filters and dosing apparatus, Chapters XXI to XXIII, inclusive, has been brought up to date and is authoritative. The authors are particularly well fitted by a long experience with trickling filters to write upon this subject. The method outlined for the hydraulic design of a nozzle field and dosing apparatus is helpful to designers, but it is not as direct as might be desired. Some treatment of the hydraulics of traveling and revolving distributors, which are becoming more popular in America, would have been helpful.

The activated sludge process, barely mentioned in the first edition because of its novelty, is treated comprehensively in the new edition, as its importance deserves. Chapter XXIV is devoted to a general discussion of the theory of the process and operating practice, and Chapters XXV and XXVI deal with plant design.

The utilization and disposal of sludge is treated comprehensively in Chapters XXVII to XXIX, inclusive. Most of the material in these chapters is new, and the many recent developments in sludge conditioning, drying and disposal are adequately described.

The last four chapters deal, respectively, with chlorination, institutional sewage disposal, industrial wastes and plant maintenance. The material has been brought up to date.

A very valuable part of this excellent book are the many data given by the authors on the actual cost of construction and operation of the different units and methods of treatment.

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FOUNDED 1848

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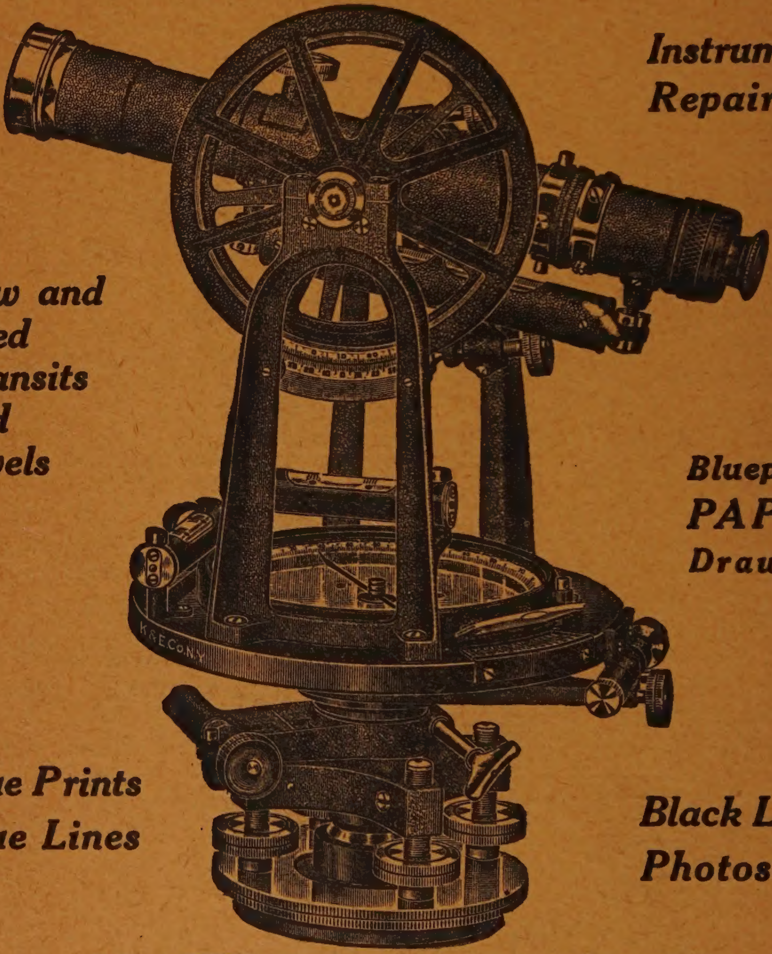

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